The Journal of Agriculture of the University of Puerto Rico

In continuation of The Journal of the Department of Agriculture of Puerto Rico

Published Quarterly; January, April, July and October of each year

MELVILLE T. COOK, EDITOR

VOL. XX OCTOBER 1936 No. 4

THE ANTS OF PUERTO RICO

BY M. R. SMITH,

Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

For approximately one year, from July 1935 to early June 1936, the writer was stationed in Puerto Rico in connection with investigations of insect pests of Puerto Rico conducted with special funds available to the Bureau of Entomology and Plant Quarantine. His particular assignment was to investigate insects attacking coffee, especially with reference to the relationship between ants and certain mealybugs and scale insects attacking coffee. In connection with the ant phase of the coffee insect problem in Puerto Rico, opportunity was given for travel over the island and, incidental to these investigations relating to coffee insects, the writer made a rather extensive collection of the ants that are found in Puerto Rico and observations concerning their occurrence. The first series of specimens of each species is deposited in the collection of the U. S. National Museum, and duplicates will be deposited in other collections.

Very little was known about the ant fauna of Puerto Rico until March 1908. During that month, Dr. W. M. Wheeler of Harvard University visited the island and made a collection and study of the ants. Although collections were made on the main island and several of the smaller, adjacent islands, no visits were made to Vieques or to the rich tropical forest of the highest mountain on the island, El Yunque. The thoroughness of Wheeler's work and the accuracy of his observations are more apparent perhaps to one like myself who has attempted to study the ants in the same localities studied by Wheeler 28 years ago. My collections and studies for the most part have been made on the western end of the island, principally in the región centering around Mayagüez where the rainfall is ap-

proximately 80 to 100 inches each year and altitudes range from sea level to about 3,000 feet (one of the peaks in the Maricao Insular Forest). I did not visit any of the smaller islands nor have I collected on El Yunque. At first thought it might appear foolish for one to collect and study ants in a region that has already been rather adequately covered. However, I spent one year on the island, whereas Wheeler had only a few weeks in which to make his observations. As a result of my longer stay on the island I was able to collect more information on the distribution, biology, and economic importance of the ants than was permitted Wheeler.

As Wheeler has previously and aptly stated, one would not expect to find as many ants on an island as on a continental area of similar size; furthermore, with an island so densely populated as Puerto Rico (465 inhabitants to the square mile) and practically all of the land in cultivation, few areas of virgin forest are left and these only on the highest mountains. My collecting in the Maricao Insular Forest, however, around altitudes of 3,000 feet has been rather disappointing. Here I found only about ten species and these included only one new form although I have searched this area for ants at least a half dozen times.

The ants that are most apt to attract the casual observer's attention in Puerto Rico are such species as the "hormiga brava", *Solenopsis geminata* Fabr.; the "hormiga loca", *Prenolepis longicornis* Latr.; the "albaricoque", *Tapinoma melanocephalum* Fabr.; and *Pheidole fallax jelskii* var. *antillensis* Forel. The habits of these ants are discussed rather fully elsewhere in this article, so the species need not be considered further here.

In 1908 Wheeler listed 51 species of ants for the island, if we omit *Neoponera villosa* Fabr., which I feel quite positive does not occur in Puerto Rico. Wolcott, in listing the ants of the Island in his Insectae Portoricensis (1923), records 55 species. I have failed, however, to include in this article 3 of the species mentioned by Wolcott, namely, *Pseudomyrma flavidula* var. *delicatula* Forel, *Monomorium minutum* Mayr, and *Camponotus cuneiscapus* Emery, there being some doubt in my mind that two of these species, at least, occur in Puerto Rico. Even with these exceptions the article includes 66 species. Of

this number 20 species (or 30.3 percent) have been described from Puerto Rico. The species referred to are as follows:

1. *Cerapachys* (*S.*) *seini* Mann
2. *Odontomachus haematoda* var. *notata* Mann
3. *Cardiocondyla venustula* Whlr.
4. *Solenopsis globularia* var. *borinquenensis* Whlr.
5. *Solenopsis globularia* var. *desecheoensis* Mann
6. *Solenopsis azteca* var. *pallida* Whlr.
7. *Pheidole subarmata* var. *borinquenensis* Whlr.
8. *Pheidole moerens* Whlr.
9. *Macromischa isabellae* Whlr.
10. *Macromischa isabellae mutica* subsp. nov.
11. *Macromischa albispina* Whlr.
12. *Macromischa albispina* subsp. *pailipes* Mann
13. *Strumigenys louisianae* var. *obscuriventris* Whlr.
14. *Myrmicocrypta brittoni* Whlr.
15. *Mycocepurus smithi* var. *borinquenensis* Whlr.
16. *Iridomyrmex melleus* Whlr.
17. *Iridomyrmex melleus* var. *fuscescens* Whlr.
19. *Myrmelachista ramulorum* Whlr.
19. *Myrmelachista ramulorum* subsp. *fortior* Whlr.
20. *Prenolepis* (*Nylanderia*) *microps* sp. nov.

Eight species (or 12.1 percent) are introduced forms. These are:

1. *Monomorium pharaonis* Linn. "Pharaoh's ant"
2. *Monomorium destructor* Jerdon
3. *Monomorium floricola* Jerdon
4. *Pheidole megacephala* Fabr.
5. *Tetramorium guineense* Fabr.
6. *Tetramorium simillimum* Nyl.
7. *Prenolepis* (*Nylanderia*) *longicornis* Latr., "crazy ant"
8. *Tapinoma melanocephalum* Fabr., "albaricoque"

The rarest ant that has been found on the Island is *Cerapachys seini*, a species representing one of the most primitive of the subfamilies of ants and not known from any other island of the West Indies than Puerto Rico. The absence of any of the

species of the subfamily *Dorylinae* is also worth remarking about. These ants are apparently very rare in the West Indies, having been collected to date only from the Islands nearest South America, namely, St. Vincent, Grenada, and Trinidad. A number of genera in Puerto Rico have only one or so species in them, such genera being *Crematogaster, Pseudomyrma, Camponotus, Tapinoma, Iridomyrmex,* etc. Some of the tropical genera like *Cryptocerus, Dolichoderus, Azteca,* and *Eciton* are devoid of any representatives at all.

In preparing this article I have drawn freely on Wheeler's bulletin, "The Ants of Puerto Rico and the Virgin Islands", and the list of ants in Wolcott's "Insectae Portoricensis". In addition to this, various colleagues have very kindly turned over to me their records which pertain to the distribution or habits of the ants as well as their associations wth other economic insects. To conserve space in the following article the names of these are given by initials. The men referred to are as follows: George N. Wolcott, Francisco Sein, Jr., W. M. Wheeler, W. M. Mann, F. E. Lutz, D. L. Van Dine, H. L. Dozier, A. H. Madden, J. W. Balock, T. H. Jones, F. M. Wadley, L. C. Fife, J. D. Moore, R. H. Van Zwaluwenberg, H. K. Plank, José Sepulveda, and the writer.

KEY TO THE SUBFAMILIES

(*for the identification of workers*)

1. Cloacal orifice round, terminal, surrounded by a fringe of hairs ---------- *Formicinae*
   Cloacal orifice ventral, slit-shaped ---------- 2
2. Petiole 1 - segmented ---------- 3
   Petiole 2-segmented ---------- 4
3. No definite constriction between the first and second gastric segments; body soft and flexible; anal glands present which often produce a very characteristic odor ---------- *Dolichoderinae*
   A definite constriction between the first and second gastric segments; body wall firm----*Ponerinae* and *Cerapachyinae*
4. Clypeus not prolonged back between the frontal carinae; median spurs of middle and hind legs pectinate; eyes excessively large; elongate, rather slender ants ---------- *Pseudomyrminae*
   Clypeus almost always prolonged back between the frontal carinae, if not, then the spurs of the middle and hind tibiae are simple or absent...*Myrmicinae*

SUBFAMILY CERAPACHYINAE

1. *Cerapachys* (*S*) *seini* Mann

Jour. Wash. Acad. Sci., Vol. 21, pp. 440-441, 1931. *Worker* Río Piedras (F. S.)

This rare ant was found by Francisco Sein in a sugar cane field at Rio Piedras, where Mr. Sein observed the larvae of the ant feeding on the larva of the sugar cane root caterpillar, *Perforadix sacchari* Sein. No other species of this rare genus has been found in any of the West Indian Islands, which thus makes the record a very unique one. It is presumed that this ant may have been imported into Puerto Rico through sugar cane introductions.

The worker of this species can be partly distinguished by its 9-segmented antenna and the lateral carina on each side which separates it from the cheek. The antennal insertions are exposed, and the frontal carine are distinct from each other.

KEY TO THE SPECIES OF THE SUBFAMILY PONERINAE

(*for the identification of workers*)

1. Mandibles linear, inserted close together at the middle of the oral border; petiole terminating in a spine or point above ---------- 2
   Mandibles inserted at the corners of the head; petiole rounded or flattened above ---------- 6
2. No oblique swellings starting from the eyes to border the antennal fossae; the latter not confluent---- 3
   On each side of the face an oblique swelling extending out from the eye and bordering the antennal fossae ---------- 4
3. Mandibles short, broadened in their distal part and narrowed just before the preapical tooth--------
   Anochetus (*A.*) *mayri* Emery
   Mandibles long, not broadened in their distal part, denticulate along the entire inner margin------
   Anochetus (*S.*) *emarginatus* subsp. *testaceus* Forel
4. Body deep black throughout; large and robust ants--
   Odontomachus haematoda Linn.
   Body of variable color ---------- 5
5. Dorsal surface of the epinotum, the petiole, and the femora brownish-red; large and robust ants------
   Odontomachus haematoda var. *notata* Mann
   Head paler; petiole with a shorter and less acuminate spine; size smaller --- *Odontomachus haematoda* var. *ruginodis* Whlr.

6. Insertions of the antennae remote; clypeus flat; claws pectinate ------ *Platythyrea punctata* F. Smith
Insertions of the antennae approximated; claws simple 7
7. Middle and hind tibiae with two spurs each---------- *Euponera* (*T.*) *stigma* Fabr.
Middle and hind tibiae with a single spur each------ 8
8. Body very glabrous ------ *Ponera ergatandria* Forel
Body opaque or subopaque ---------- 9
9. Head with numerous punctures which give the general surface a subopaque effect ---------- 10
Head with fewer punctures which give the general surface a more glabrous appearance--*Ponera trigona* var. *opacior* Forel
10. Petiole viewed from the side distinctly rectangular shaped, almost as wide dorsally as ventrally----- *Ponera opaciceps* Mayr
Petiole viewed from the side very distinctly narrower dorsally than ventrally ------ *Ponera opaciceps* var. *jamaicensis* Aguayo

SUBFAMILY PONERINAE

2. *Platythyrea punctata* F. Smith.

Cat. Hymen. Brit. Mus., Vol. 6, p. 108, 1858. *Worker, Male*
Between Arecibo and Utuado (W. M. W.); Mayagüez (M. R. S.)

This ant, which is common throughout the West Indies, seems to prefer to nest in well-shaded locations. I have found it nesting in stumps and logs in colonies of only a hundred or two hundred individuals. The highly predacious workers forage singly on the ground or even up the trunks of trees. When alarmed they run with considerable speed.

The worker, although black, has such a dense coat of pubescence on its body that the latter imparts a pruinose or metallic effect. As the name indicates, the body is covered with numerous and conspicuous punctures.

3. *Euponera* (*T.*) *stigma* Fabr.

Syst. Piez., p. 400, 1804. *Queen*
Culebra (W. M. W.); Utuado (W. M. W.); Mayagüez, Maricao Insular Forest (M. R. S.)

This species nests by preference in well-rotted stumps and logs, or in the soil beneath stones in shaded areas. These ants

seem to like abundant moisture and are most often found near the bases of stumps. The colonies comprise only a few hundred individuals. Cocoons are light yellowish or sulphur colored. Specimens have been taken at altitudes as high as 3,500 feet. Workers, although predacious, are not commonly seen foraging openly in the woods like some of the *Odontomachus* and other ants. The workers are also slower of movement than some of the other Ponerine ants. On October 1 and November 20 both winged males and winged females were noted in a nest. The former are exceedingly active.

The worker is very deep brown or blackish with lighter appendages. The meso-and metapleurae are longitudinally straited, and the epinotum is laterally compressed.

4. *Ponera ergatandria* Forel.

Trans. Ent. Soc. London, p. 365, 1893. *All castes.*

Utuado (W. M. W.); Guayama, Sabana Grande, Lajas (H. L. D.); Ensenada, Mayagüez (M. R. S.)

This species appears capable of living in both very arid and moist habitats. I have found colonies nesting in the soil and in decaying logs and stumps, and Dozier has collected workers from cow dung on numerous occasions. Like the Ponerine ants previously mentioned, the workers are predacious and the colonies small. As the specific name indicates, this species has males in which both worker and male characters occur in the same individual.

P. ergatandria seems to be a common species in the islands of the West Indies.

The worker is characterized by its very short antennal scapes, which lack considerably of reaching the posterior border of the head, its small size (2.5-2.7 mm.), its glabrous appearance, and peculiarly shaped petiole.

5. *Ponera opaciceps* Mayr.

Verh. Zool. Bot. Ges. Wien., Vol. 7, p. 536, 1887. *Worker, Male.*

Culebra (W. M. W.); Utuado, Monte Morales, Monte Man-

dios, and Coamo Springs (W. M. W.); Sabana Grande, Lajas (H. L. D.); Mayagüez, Ensenada (M. R. S.)

This is probably the commonest species of *Ponera* in Puerto Rico. Its habits are similar to those of the preceding species. Specimens have also been collected from beneath cow dung at frequent intervals.

The worker, which is from 3 to 3.2 mm. in length, is black with light brown appendages; its head is opaque, and the petiole when viewed from the side is rectangular shaped, that is, not shorter dorsally than ventrally.

6. *Ponera opaciceps* var. *jamaicensis* Aguayo.

Bull. Bklyn. Ent. Soc., Vol. 27, pp. 216-217, 1932. *Worker* Ensenada (H. L. D.); 18 kilometers north of Yauco (M. R. S.)

I have referred to this variety a number of specimens collected in the above-mentioned localities. These differ from typical specimens of *opaciceps* in the following characters: (1) shorter antennal scape, (2) narrower petiolar border, (3) more glabrous body surface, etc. Workers have been collected from the same type of habitats and under the same conditions as those of the species.

7. *Ponera trigona* var. *opacior* Forel

Trans. Ent. Soc. Lond., Pt. A, pp. 363-364, 1893. *Worker, Queen.*

14 kilometers east of Mayagüez (M. R. S.)

This species has habits similar to those of *opaciceps* and *ergatandria.* The ants are recorded from Cuba, Jamaica, and the Dominican Republic in the West Indies.

The worker of *opacior* can be distinguished from the worker of *opaciceps* by the shape of its petiole and the sculpturing of the head, and from the worker of *ergatandria* it is distinguished by its longer antennal scapes, less glabrous body, and rounder epinotal declivity.

8. *Anochetus mayri* Emery

Ann. Mus. Civ. Genova, Vol. 21, p. 378, 1884. *Worker*

Utuado, Vega Baja, Monte Morales, Monte Mandios, Coamo Springs, San Juan, Adjuntas, Arecibo (W. M. W.); Mayagüez, Maricao, Arecibo, Maricao Insular Forest (M. R. S.)

This ant seems to be the most common species of the genus in the West Indies. Colonies are exceedingly small, comprising only a few individuals. Although the ants seems to nest by preference in shaded areas, I have also found them colonized in the open. Their colonies may be found either in the soil or in the decaying wood of stumps and logs. The workers, which are slow of movement, forage singly. Cocoons are light yellowish, with a black spot at one end. Several winged queens were noted in a nest on August 10.

The characters given in the key to the species clearly distinguish this species from the following one.

9. *Anochetus emarginatus* subsp. *testaceus* Forel.

Trans. Ent. Soc. Lond., p. 356, 1893. *Worker, Male*
Culebra (W. M. W.)

I have not encountered this ant on the western end of the Island of Puerto Rico where I have done most of my collecting. This species may occur, however, on the eastern end of the Island.

Wheeler states that he found "several colonies nesting under stones in the shade of trees along the dry arroyos on the higher part of the Island of Culebra." He also states that the colonies are small, numbering only from about thirty to a hundred individuals.

10. *Odontomachus haematoda* Linn.

Syst. Natur., Ed. Vol. 10, p. 582, 1758 *Worker*
Arecibo, Utuado, Monte Morales, Monte Mandios, Adjuntas, Vega Baja, Aibonito, Coamo Springs (W. M. W.); San Germán, Mayagüez, 10 kilometers northwest of Ponce, 18 kilometers north of Yauco (M. R. S.)

This species nests by preference in shaded areas. It is very common in the coffee groves of the hills and mountains. Colonies may be found in the soil or in the well-rotted wood of

logs and stumps. Most of the nests appear to contain several hundred individuals. The workers have foraging habits similar to the species mentioned above. A large number of winged queens were found in a nest on March 20 and males on April 5. The workers can leap several inches by closing their widely opened mandibles suddenly, thus making a clicking sound in doing so. Their sting, although slightly painful, does not last long.

The typical worker of this species is large and robust, and of a deep blackish color, with slightly lighter appendages.

11. *Odontomachus haematoda* var. *notata* Mann.
Bull. Amer. Mus. Nat. Hist., Vol. 42, p. 404, 1920. *Worker*
Monte Mandios (W. M. W.)

I have not encountered any specimens which I could positively refer to this variety. This form is only a color variation of the species and was collected by Wheeler from a high peak.

The characters given in the key to the species will serve to distinguish this ant from the typical *haematoda*.

12. *Odontomachus haematoda* var. *ruginodis* Whlr.
Bull. Amer. Mus. Nat. Hist., Vol. 21, p. 82, 1905. *Worker, Queen*

Utuado, Adjuntas, Coamo Springs (W. M. W.); Guánica (D. L. Van D.); Rio Piedras (G. N. W.); Vieques Island (collector?)

This variety is not as common as *haematoda*. The ants differs from the latter by preferring for nesting sites open, sunny areas, especially river bottoms.

Characters given in the key will aid in distinguishing this species.

SUBFAMILY PSEUDOMYRMINAE

13. *Pseudomyrma flavidula* F. Smith.

Catalog. Hymen. Brit. Mus., Vol. 6, p. 157, 1858. *Worker*
Tallaboa (W. M. W.); Lajas (H. L. D.); Las Marías, Mayagüez,, and Mani Beach, 4 miles north of Mayagüez (M. R. S.)

This species usually nests in the branches and twigs of trees, the stems of plants, or occasionally in crevices beneath

bark. Colonies are not large, consisting of only a few dozen to several hundred individuals. The workers diligently run over plants in search of honey-dew excreting insects. They have been commonly noted attending the green and hemispherical scales on coffee. Undoubtedly the ants are also highly predacious.

The worker of this species can be recognized by its narrow, elongate body, exceedingly large eyes, general yellow color, and on the gaster the presence of a pair of prominent black spots near the base.

KEY TO THE SPECIES OF THE SUBFAMILY MYRMICINAE

(*for the identification of workers and soldiers*)

1. Antennae 4-6 segmented ---------- 2
   Antennae with more than 6 segments ---------- 6
2. Antennae with 4 segments -------- *Epitritus emmae* Emery
   Antennae with 6 segments ---------- 3
3. Mandibles long and slender, close together at their insertions, with only two borders, an internal and an external, usually parallel or subparallel and overlapped by the clypeus only at their bases---- 4
   Mandibles shorter, some distance apart at their insertions, with three borders, i. e., with the internal border differentiated into a basal and a more apical (masticatory) border, and overlapped for a considerable distance by the anterior border of the clypeus ---------- *Strumigenys membranifera* subsp. *simillima* Emery
4. Inner borders of mandibles without teeth but with a series of minute denticles --- *Strumigenys eggersi* Emery
   Inner borders of mandibles with teeth---------- 5
5. Inner border of mandibles with a single subapical tooth ---------- *Strumigenys louisianae* var. *obscuriventris* Whlr.
   Inner border of mandibles with two long, and approximated teeth near the apex---------- *Strumigenys rogeri* Emery
6. Postpetiole articulated to the dorsal surface of the gaster, which is flattened dorsally, more convex ventrally and acutely pointed---- *Crematogaster steinheili* Forel
   Not as above ---------- 7
7. Workers strongly dimorphic, that is, without intermediates connecting the extreme forms; antennal

club 3-segmented ---------- 8
Workers monomorphic; or else polymorphic, that is, with mediae intermediate between the major and minor forms ---------- 13

8. Head very strikingly elongate and with subparallel sides; all parts of body except appendages smooth and shining ---------- *Pheidole subarmata* var. *borinquenensis* Whlr.
Not as above ---------- 9

9. Clypeus carinate, also transversely rugulose---------- *Pheidole fallax jelskii* var. *antillensis* Forel
Not as above ---------- 10

10. Entire head sculptured, opaque, except the region immediately surrounding the occipital foramen, which is smooth and shining ---------- *Pheidole flavens* subsp. *sculptior* Forel
Only anterior three-fourths of the head sculptured, and opaque ---------- 11

11. Antennal scrobe of the head well defined and with a distinct lateral carina ----------*Pheidole flavens* subsp. *exigua* Mayr.
Not as above ---------- 12

12. Anterior border of gula with two distinct teeth------ *Pheidole moerens* Whlr.
Anterior border of gula without teeth------ *Pheidole megacephala* Fabr.

13. Antennae with 10 segments, the last two segments forming a distinct club ---------- 14
Antennae with more than 10 segments ---------- 19

14. Workers polymorphic, i. e., with major, intermediate, and minor forms ----*Solenopsis geminata* Fabr.
Workers monomorphic ---------- 15

15. Postpetiole exceedingly large; transversely elliptical in shape and distinctly broader than long------ 16
Not as above ---------- 17

16. Body jet black, with lighter appendages--- *Solenopsis globularia* var. *desecheoensis* Mann.
Only the posterior portion of the head, the pronotum, and the whole, or nearly the whole of the first gastric segment dark brown, in some specimens almost black -------- *Solenopsis globularia* var. *borinquenensis* Whlr.

17. Entire body black and shining- *Solenopsis picea* Emery
Not as above ---------- 18

18. Clypeal border without teeth; body yellow excepting the posterior portion of the head and the first gastric segment which are slightly infuscated ------ *Solenopsis azteca* var. *pallida* Whlr.

Clypeal border with teeth; color arrangement not as above ---------- *Solenopsis corticalis* Forel

19. Epinotum unarmed ---------- 20
Epinotum armed ---------- 24

20. Hairs of the body appressed, scale-like; antennal foveae prolonged to the corners of the head------ *Cyphomyrmex rimosus* subsp. *minutus* Mayr.
Not as above ---------- 21

21. Workers polymorphic; head, though shining, with well scattered, prominent punctures ---------- *Monomorium destructor* Jerdon
Workers monomorphic ---------- 22

22. Body uniformly deep brownish black to jet black--- *Monomorium carbonarium* subsp. *ebeninum* Forel
Body of a different coloration ---------- 23

23. Only the head and gaster dark brown or blackish----- *Monomorium floricola* Jerdon
Entire body yellow, excepting for a slight infuscation at the base of the gaster---------- *Monomorium pharaonis* Linn.

24. Body with spines or tubercules ---------- 25
Body without spines or tubercules ---------- 26

25. Frontal carinae very close to each other, and dilated at the anterior extremity; clypeus not distinctly prolonged back between them----*Myrmicocrypta brittoni* Whlr.
Frontal carinae separated, embracing the posterior extremity of the clypeus ---------- *Trachymyrmex jamaicensis* André

26. Clypeus armed with only two longitudinal ridges---- *Rogeria curvipubens* Emery
Clypeus not as above ---------- 27

27. Antennal scrobes bordered below by a carina of the cheek -------- *Wasmannia auropunctata* Roger
Antennal scrobes not bordered below by a carina of the cheeks ---------- 28

28. Posterior margin of the clypeus elevated in the form of a welt or ridge bordering the antennal fossa in front ---------- 29
Not as above ---------- 31

29. Body black----------*Tetramorium lucayanum* Whlr.
Body not not black ---------- 30

30. Head, thorax, petiole and postpetiole coarsely rugose-reticulate; hairs on thorax simple---------- *Tetramorium guineense* Fabr.
Sculpture finer; hairs on thorax short and clavate--- *Tetramorium simillimum* F. Smith

31. Antennae 11-segmented, frontal carinae close to each other and dilated at the anterior extremity------ *Mycocepurus smithi* var. *borinquenensis* Whlr.
Antennae 12 segmented; frontal carinae neither closely approximated nor dilated anteriorly ---------- 32
32. Middle and hind tibiae without spurs; petiole with long cylindrical peduncle and a broad oval node; postpetiole unusually large; body hairs simple------ 33
Not presenting all the above characters; either the spurs present, or the body hairs clavate -------- 34
33. Size 2.2 to 2.5 mm.; head black------- *Cardiocondyla venustula* Whlr.
Size smaller; head light reddish brown; antennal scapes infuscated toward the tips-*Cardiocondyla emeryi* Forel
34. General body color blue-black ---------- 35
Only the head, coxae, femora, and gaster blue-black-- 36
35. Legs only slightly darker (fuscous) than the remainder of the body; size 2 to 2.5 mm.---*Macromischa albispina* Whlr.
Legs much paler (yellowish white); size 1.5 mm.----- *Macromischa albispina* subsp. *pallipes* Mann
36. Epinotum spined ------ *Macromischa isabellae* Whlr.
Epinotum unarmed --------- *Macromischa isabellae mutica* subsp. nov.

SUBFAMILY MYRMICINAE

14. *Monomorium carbonarium* subsp. *ebeninum* Forel.

Mitth. Munch. Entom. Ver., Vol. 5, p. 8, 1881. *Worker* Culebra (W. M. W.); Santurce, Utuado, Coamo Springs, Aibonito, Adjuntas, Arecibo, Vega Baja (W. M. W.); Guánica, San Sebastiáan (G. N. W.); Mayaguez, Lares, Las Marías (M. R. S.)

This is one of the most common ants of the West Indies. It occupies the same status in these Islands that *M. minimum* Buckley does in the United States. It forms populous colonies, which are characterized by having many reproductive queens to a colony. Their great adaptability is indicated by the fact that the species nests in both soil and wood, back of the leaf sheaths or corn and bananas, in cabbage heads, Tillandsias, and in the fruits of *Hibiscus sabdariffa*. The workers are exceedingly fond of honeydew. They have been noted attending such insects as *Saissetia hemispherica* Targ., *Coccus viridis* Green, the aphid *Sipha flava* Forbes, etc. The ants are also highly predacious.

Although they have not been observed infesting houses, there is little doubt that they would do so if given the opportunity.

The worker is easily recognized by its shining black or deep brownish color, 3-segmented antennal club, lack of epinotal spines, and cuboidal shaped epinotum.

15. *Monomorium destructor* Jerdon.

Madras Jour. Lit. and Sci., Vol. 17, p. 105, 1851. *Worker* Tallaboa (W. M. W.); Guayama, Sabana Grande, Ponce (H. L, D.); Mayaguez and Ensenada (M. R. S.)

The indications are that this species is an imported ant. Should an intensive search be made for it, the ants would probably be found in many of the seaport towns, if not elsewhere. At Mayagüez the species was found nesting in a bakery where the ants made numerous trails on the walls and floors, composed of enormous numbers of workers. Dealated queens have been seen moving along in the trails with the workers. The colonies of *destructor* must be composed of thousands of individuals if one is to judge from the number and size of their trails. Like *M. ebeninum*, they are polygynous. An inmate of the bakery said the ants were fond of sweets and meats, but did not seem to care for flour or lard. In a very dry and arid pasture at Ensenada the ants were found nesting in the soil at the base of trees and also in the soil under rocks. Workers have frequently been noted attending soft scales, psyllids, and other honeydew-excreting insects. They are also highly predacious.

Workers can be recognized by their yellowish color, their shining bodies, and by the fact that they are highly polymorphic.

16. *Monomorium floricola* Jerdon.

Madras Journ. Lit. and Sci., Vol. 17, p. 107, 1851. *Worker* Culebra (W M. W.); Vega Baja, Coamo Springs, Tallaboa (W. M. W.); Lares, Peñuelas, Sabana Grande, San Germán, Humacao, Caguas (G. N. W.); Mayaguez, Ceiba Baja (M. R. S.)

This ant, unlike the two preceding species, seems to prefer wood for nesting purposes. Moderate-sized colonies have been noted in the twigs of trees, beneath the bark of trees, etc., and in Tillandsias. Like the other species of this genus *floricola* has many reproductive queens per colony. This species is also

noted for producing ergatoid females, that is, females which were apparently never meant to be winged. The workers are exceedingly fond of honeydew as well as organisms. I have commonly seen the ants attending the green and hemispherical scales on coffee. The workers of this species made themselves quite objectionable by stealing insects for food from our insectary.

The worker of *M. floricola* is quite easy to distinguish by its 3-segmented antennal club; lack of epinotal spines; dark head and gaster, with light-colored thorax; and its general glabrous appearance.

17. *Monomorium pharaonis* Linn.

Syst. Natur., Ed. 10, p. 580, 1758. *Worker.*

Culebra (W. M. W.); San Juan, Arecibo (W. M. W.); Mayagüez, (M. R. S.)

This imported species, which is rapidly becoming disseminated over the entire world, has not yet been recorded many times from the Islands of the West Indies. This may be due to lack of a sufficient search for it. The ant, which is commonly known as "Pharaoh's" ant, is highly adapted for living in urban areas, where its very populous colonies nest in the woodwork and masonry work of dwellings, stores, etc. Like other species of *Monomorium*, its colonies are polygynous. The ants are practically omnivorous in their feeding habits. In a country with as mild a climate as Puerto Rico this ant should be capable of living outdoors as well as inside dwellings.

The worker, which is of a pale yellowish color, is characterized by its lack of epinotal spines, presence of a 3-segmented antennal club, and punctate and subopaque appearing body. The gaster is distinctly infuscated near the base.

Fig. 1. *Cardiocondyla emeryi* Forel (After Wheeler.)

18. *Cardiocondyla emeryi* Forel

Mit. Munch. Entom. Ver., Vol. 5, p. 5, 1881. *Worker*

Vieques (Busck); Culebra (W. M. W.); San Juan, Santurce, Utuado, Adjuntas, Coamo Springs (W. M. W.); Sabana Grande, Lajas (H. L. D.); Tres Hermanos, Mani Beach, Mayagüez, Guánica, Ensenada (M. R. S.)

This is a very common species of ant in the West Indies, as numerous records indicate. It is also recorded from India, Palestine, Madagascar, Florida, etc. Due to the extremely small size of the worker and its habit of commonly foraging alone, the species is easily overlooked by the collector. Wheeler states that " the colonies of this ant are small and occur in sandy places, especially in river or creek bottoms and on sea beaches." While it is true that they are commonly found in such habitats the species in Puerto Rico is by no means confined to such areas, for I have found them nesting in clay soils considerably removed from stream beds. Their nest entrances are extremely small and may easily be overlooked. On a number of occasions workers have been collected from cow dung. Undoubtedly the ant is highly predacious, but it is also given to attending honeydew-excreting insects to some extent.

The worker is recognized by its distinctive coloration, all of the body being light reddish brown except the gaster and the antennal club. The worker differs from that of *C. venustula* in its more angular thoracic humeri, more slender petiole, difference in coloration, size, etc.

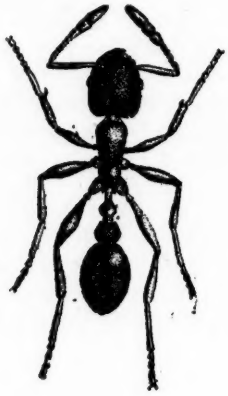


Fig. 2. *Cardiocondyla venustula* Wheeler. (After Wheeler.)

19. *Cardiocondyla venustula* Whlr.

Bull. Amer. Mus. Nat. Hist. Vol. 24, pp. 128-130, 1908. *Worker, Queen.*

Culebra (W. M. W.); Coamo Springs (W. M. W.); Ponce, Guayama, Coamo (H. L. D.); Mayagüez (M. R. S.)

This species is apparently not so common as the preceding in Puerto Rico or in any of the other West Indian Islands.

Wheeler, who described *venustula* from Puerto Rican specimens in 1908, remarks that the ant "is not uncommon in sandy and gravelly places, especially on the sea-beaches, where it lives in small colonies, comprising a single dealated queen and a few dozen workers, in shallow nests like those of some species of *Leptothorax*." He noted winged females on March 23.

Dozier collected workers on several occasions from dry cow dung in very arid pasture areas at both Ponce and Coamo. Nothing is known concerning the food of these ants but they are thought to be mainly predacious.

The worker of *venustula* may be distinguish from that of *C. emeryi* by its larger size (2.0-2.5 mm.), rounder thoracic humeri, broader petiole, and darker and more opaque appearance.

20. *Solenopsis azteca* var. *pallida* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 24, p. 131, 1908. *Worker*

Coamo Springs (W. M. W.); 14 kilometers east of Mayagüez (M. R. S.)

Wheeler found this ant nesting in the soil beneath a boulder in a dry stream bed. The specimens which I have referred to this species were quite common in stumps and logs in a coffee grove. They were usually found just beneath the bark. Winged queens were noted on December 13.

My specimens agree with Wheeler's brief characterization of the workers as having a yellowish body, with the vertex of the head and the first gastric segment slightly infuscated, and the presence of two well-developed clypeal carinae, but no teeth on the clypeal border.

21. *Solenopsis corticalis* Forel.

Mitth. Munch. Entom. Ver., Vol. 1, p. 13, 1881. *Worker, Queen.*

Utuado (W. M. W.); 16 kilometers east of Mayagüez, Lajas (M. R. S.)

This species is recorded by Wheeler as having been found nesting in the stem of a bamboo. I have referred to *corticalis* specimens collected from clay soil at an altitude of 650 feet. Workers have also been noted attending the pineapple mealybug. The species is not recorded from any of the other West Indian Islands except St. Thomas.

Very little is known concerning the biology of the ant.

22. *Solenopsis picea* Emery.

Bull. Soc. Ent. Ital., Vol. 28, p. 1896. *Worker Queen.*

Utuado (W. M. W.)

This ant is recorded only from Cuba and Puerto Rico. A single colony was found by Wheeler nesting under the bark of a rotting log.

As the name indicates, the worker is very dark, and glabrous, differing thus from the other monomorphic forms mentioned in this paper, with which it might be confused.

I have no information on the biology of the species.

23. *Solenopsis geminata* Fabr.

Syst. Piez. No. 6, p. 423, 1804. *Worker.*

Culebra (W. M. W.); Arecibo, Adjuntas, San Juan, Santurce, Vega Baja, Utuado, Monte Morales, Monte Mandios, Coamo Springs, Ponce, Tallaboa (W. M. W.); Guánica, Lajas, Ponce, Ensenada (H. L. D.); Mayagüez, Juana Díaz, Tres Hermanos, Maricao Insular Forest, etc. (M. R. S.)

The "hormiga brava" is not only one of the most common ants in Puerto Rico, but also of the entire West Indies. It is perhaps better known by the natives than any other ant. Their encounters with this vicious and aggressive ant have not only resulted in their respecting it but also in giving it the name "brave ant". I have seen colonies of this ant from sea level to an altitude of approximately 3,000 feet. Although this ant prefers to nest in open sunny places, its nests on some occasions are found in lightly shaded woods. The typical nest is a mound of loose earth with several entrances leading into it, but the ants may nest in the soil beneath cow dung or in other places. Their colonies are composed of thousands of individuals. Fertile, dealated queens are capable of starting colonies unaided.

This is one of the most versatile ants known. The workers are noted for their predaciousness, as well as for their love of seeds, the juices or sap of plants, and honeydew. To one who has lived in Puerto Rico it would seem that there are very few plant lice, soft scales, mealybugs, etc., that these ants do not attend. The fostering attitude shown by the worker toward the pineapple mealybug (*Pseudococcus brevipes* Cockll.) makes it a very serious problem in combating the latter insect. The "hormiga brava" is without doubt the most important ant pest in the island for the following reasons: (1) its vicious stinging habit, (2) the stealing of small seeds from seed beds, (3) the attendance on and fostering care exhibited toward honey-dew excreting insects, (4) its habit of gnawing into plants, fruits, and trees. It is also presumed that the ants may gnaw holes in clothing, kill young poultry or birds as these emerge from the egg, and invade houses as does the fire ant (*Solenopsis xyloni* McC.) in the southern part of the United States.

Several specimens of a phorid fly, *Pseudaceton antiguense* Cwfd., were captured around the nest of a colony of this ant at a locality 17 kilometers east of Mayagüez.

The worker of the fire ant is polymorphic, is highly variable in color, ranging from reddish brown to black, glabrous, possesses a 2-segmented antennal club, and has no epinotal spines.

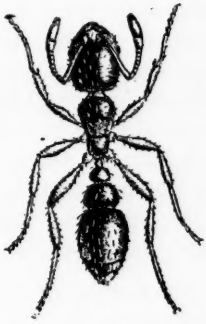


Fig. 3. *Solenopsis globularia* var. *borinquenensis* Whlr. (After Wheeler.)

24. *Solenopsis globularia* var. *borinquenensis* Whlr.

Bull Amer. Mus. Nat. Hist., Vol. 24, p. 131, 1908. *Worker* Culebra (W. M. W.); El Morro at San Juan (W. M. W.)

Wheeler, who described this variety from specimens gathered at the above- named localities, states that it "nests in the white sand of the sea beaches just above the high water mark." Although I have collected ants on numerous occasions in such places, these specimens have apparently been too dark for me to refer them to *borinquenensis*, so I have assigned them to the following species instead.

This ant has been recorded from Santo Domingo as well as Haiti.

The worker is distinguished from that of the typical species in that the posterior portion of the head, the pronotum, and the whole or nearly the whole of the first gastric segment are dark brown, in some specimens almost black.

25. *Solenopsis globularia* var. *desecheoensis* Mann.

Bull. Amer. Mus. Nat. Hist., Vol. 42, p. 428, 1920. *Worker*

Desecheo Island (W. M. W.); Ensenada, Lajas, Lake Guánica, Coamo (H. L. D.); Mayagüez (M. R. S.)

This species was described by Mann from specimens collected on Desecheo Island, with no remarks given as to their nesting habits or biology.

Many specimens have been taken by Dozier from cow dung in dry, arid cattle pastures at the above-named localities. I have also taken workers on several occasions along the sandy beach at Mayagüez, only 10 feet or so from the Caribbean Sea. These were thought to be nesting in the soil, but I was unable to locate their nests definitely. One would judge that their colonies are not very populous, comprising perhaps only a few hundred individuals. The ants are undoubtedly largely predacious. The workers crawl very slowly and usually forage singly.

Mann states that the worker of this variety differs from that of *globularia* in having a jet black body and (yellowish brown) appendages.

26. *Pheidole fallax jelskii* var. *antillensis* Forel.

Mitth. Munch. Ent. Ver., Vol. 1, p. 4, 1881. *Worker.*

Culebra (W. M. W.); Utuado, Monte Morales, Monte Mandios, El Morro at San Juan, Santurce, Coamo Springs, Vega Baja (W. M. W.); Tres Hermanos, Mayagüez, Hormigueros, Ensenada, Maricao Insular Forest, Juana Díaz (M. R. S.); Toa Baja, Yauco, Río Piedras (G. N. W.); Lajas, Sabana Grande, Ponce, Coamo, Humacao (H. L. D.)

This is not only one of the most common ants in Puerto Rico but also in the entire West Indies. I have seen colonies in Puerto Rico from sea level to approximately 3,000 feet altitude. The fairly populous colonies are usually found in open, sunny areas regardless of whether these be bare or grassy. The nest can be easily recognized by the peculiar elongate, slit-shaped entrance holes. The ants are so versatile that they even nest in the cracks of pavement, the crannies of masonry work, etc. The rather large, slender workers of this species can be observed bringing into the nest literally hundreds of insects and other

organisms. Their food is largely flesh, and so strongly does this predominate that the ants have a distinct fecal odor. Workers have been collected very frequently from dung, and it is believed that the ants live to a large extent on the insects that inhabit this material. I have noted the workers on several occasions attending the green and hemispherical scales, the aphid, *Pentalonia nigronervosa* Coquerel on bananas, etc., thus indicating that the diet of this ant is not entirely flesh. A. H. Madden found both workers and soldiers in the stomach of the Surinam toad, *Bufo marinus*.

On August 14 queen pupae were noted in a colony, and on December 18 winged males and winged queens.

The soldier of *Ph. antillensis* is easily distinguished from the soldiers of other Puerto Rican species of *Pheidole* by its large size and reddish-brown body. The head of the soldier is very coarsely rugulose-recticulate and subopaque.

27. *Pheidole flavens* subsp. *exigua* Mayr

Horae Soc. Entom. Ross., Vol. 18, p. 36, 1884. *Soldier*

Utuado, Monte Mandios, Coamo Springs (W. M. W.); 14 kilometers east of Mayagüez, (M. R. S.); Cayey (G. N. W.)

This species is apparently not so common in Puerto Rico as some of the other forms of the genus. So far it has not been recorded from any of the other West Indian Islands. Wheeler found colonies of this ant nesting in the soil beneath stones and logs in coffee groves. I have noted the ants on two occasions in a similar habitat nesting in rotten stumps and also in the ground at the base of a stump. The colonies appear to be very small, being composed of only a few hundred individuals. The ants are without doubt principally flesh feeders.

The soldier of *exigua*, as its specifiic name indicates, is easily recognized by its distinct antennal scrobe, which is set off from the remainder of the head by a well-defined lateral carina. The anterior three-fourths of the head is subopaque; the color of the head, thorax, and pedicel is pale reddish brown. The queen is unusually small and dark colored.

28. *Pheidole flavens* subsp. *sculptior* Forel

Trans. Ent. Soc. Lond., p. 414, 1893. *Soldier, Worker, Queen*

Coamo Springs (W. M. W.); 4 miles east of Mayagüez, 6 miles southeast of Mayagüez (M. R. S.)

Small colonies of this ant have been found on a number of occasions in rotten stumps in coffee groves. A colony was also collected from the sandy soil of the beach beneath a coconut husk. The food habits of this ant are probably the same as those of the preceding species. Winged queens were found in colonies on August 23, September 20, and October 4. Winged males were noted in similar circumstances on August 14 and October 14.

The characters mentioned in the key to the species will serve to distinguish the soldier of this ant from that of the soldier of other species of *Pheidole.*

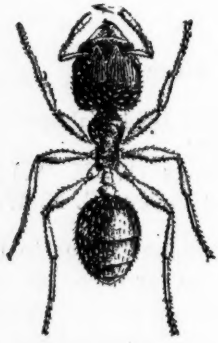


Fig. 4. *Pheidole moerens* Wheeler: soldier. (After Wheeler.)

Fig. 5. *Pheidole moerens* Wheeler: worker. (After Wheeler.)

29. *Pheidole moerens* Whlr.

Bul. Amer. Mus. Nat. Hist., Vol. 24, p. 136-137, 1908. *Soldier, Worker*

Culebra (W. M. W.); Utuado, Monte Morales, Monte Mandios (W. M. W.); Ponce, Coamo (H. L. D.); Yauco, Mayagüez, Maricao Insular Forest (M. R. S.)

Although this is one of the commonest species of *Pheidole* in Puerto Rico, it has not yet been recorded from any of the other West Indian Islands. I have found it especially abundant in the hills and mountains, particularly in coffee groves. The species has been taken at altitudes as high as 3,000 feet. The small colonies of *moerens* may be found in the soil beneath stones or logs, or in the wood of logs and stumps. Often the ants nest in the very soft, moist wood. None of the soldiers and workers have been observed attending scales and plant lice, hence it is inferred that the ants are principally if not exclusively flesh feeders. Winged males were seen in a colony on November 21, and both winged males and winged queens on March 24.

The soldier can be recognized by the posterior fourth of the head being smooth and shining, the gula having two prominent teeth, the prothorax transversely rugulose, and the dorsal surface of the postpetiole glabrous.

30. *Pheidole megacephala* Fabr.

Ent. Syst. Vol. 2, p. 361, 1793. *Soldier*

Culebra (W. M. W.); Aibonito, Arecibo, Mayagüez (W. M. W.); Río Piedras ,Cayey (G. N. W.); Mayagüez (M. R. S.)

This imported species, so far as I know, is confined to the towns in Puerto Rico. Undoubtedly the ants occur in many more localities than are mentioned above. The species is also well scattered throughout the West Indian Islands. I found the ants in my back yard nesting in the soil beneath stones and in cracks beneath the concrete walks. On numerous occasions they were noted foraging in the kitchen. On the roots of the grass *Eleusine indica* they were noted attending the pineapple mealybug (*Pseudococcus brevipes*). The ants are fond of honeydew in spite of their love for flesh. A colony has numerous fertile queens in it, thus accounting for its populousness. *P. megacephala* is apparently a mortal enemy of the "hormiga brava", as these two species have been seen fighting on numerous occasions.

On January 28 many winged males were noted in a colony.

The soldier is recognized by its exceedingly large head, almost the entire posterior half of which is smooth and shining,

the gula has no teeth, the epinotal spines are acute, and the postpetiole is sharply conulate on the sides; the color is a deep brown, with the apical section of the gaster darker.

Fig. 6. *Pheidole subarmata* var. *borinquenesis* Wheeler: soldier. (After Wheeler.)

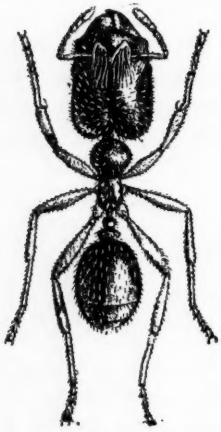


Fig. 7. *Pheidole subarmata var. borinquenensis* Wheeler: soldier. (After Wheeler.)

Fig. 8. *Pheidole subarmata var. borinquenensis* Wheeler: worker. (After Wheeler.)

31. *Pheidole subarmata* var. *borinquenensis* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 24, p. 133-134, 1908. *Soldier, Worker.*

El Morro at San Juan, Santurce, Utuado (W. M. W.); Hatillo, Lajas, Sabana Grande (H. L. D.); Mayagüez, Juana Diaz, Tres Hermanos, Lares (M. R. S.)

This rather common species of Puerto Rican ant has not yet been recorded from any of the other West Indian Islands. Wheeler states that the formicaries "are small craters thrown up in sandy, sunny places like roads and creek bottoms." He

also remarks that there are only a few soldiers and workers in a colony. I have found the ants nesting in both clay and sandy soils. Madden noted the soldiers and workers feeding on the eggs and nymphs of the mole cricket *Scapteriscus vicinus*. Latr. He also took these ants from the stomach of the Surinam toad. Dozier found the soldiers and workers quite common in cow dung. I have noted the ants attending the pineapple mealybug, the aphid *Pentalonia nigronervosa* on plantain, the green and the hemispherical scales, etc.

The soldier of this species is very easily distinguished by its very elongate head, the borders of which are subparallel; the considerably elevated frontal carinae and the smooth, glabrous surface of the body.

32. *Crematogaster steinheili* Forel

Mitth. Munch. Entom. Ver., Vol. 1, p. 15, 1881. *Worker*

Culebra (W. M. W.); Coamo Springs, Vega Baja, Aibonito (W. M. W.); Guayama (J. D. M.); Fajardo (G. N. W.); Ensenada, Mayagüez, San Germán, Lajas, Guánica (M. R. S.)

C. steinheili is the only species of *Crematogaster* that has been taken in Puerto Rico to date. It is not only a fairly common ant in Puerto Rico but it is also common in many of the other West Indian Islands. Colonies which are moderately populous and contain many fertile queens are found in rotten wood, in cavities in twigs of plants, under the bark of trees, at the base of and between the leaf sheaths of Tillandsias, etc. On one occasion a nest was found in the soil beneath a rock. I have found the ants in some of the driest areas of the island as well as some of the most moist, hence am led to conclude that it is a highly adaptable species.

The workers are exceedingly fond of honey-dew. They have been noted on numerous occasions attending mealybugs, soft scales, and plant lice. It is a very common custom with this species to built a carton like covering over the insects which they are attending. Many of the honey-dew excreting forms attended are economic species, such as a *Aphis gossypii* Glov., *Pseudococcus nipae* Mask., *Ps. brevipes*, and *Toxoptera aurantiae* Koch. The ants are probably flesh feeders also. When alarmed the worker has the habit of turning up the posterior portion of its gaster, like many of the other ants of the genus.

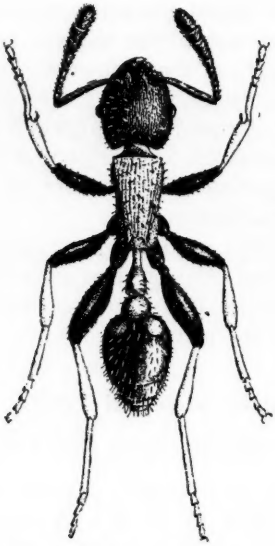


Fig. 9. *Macromischa isabellae* Wheeler (After Wheeler.)

33. *Macromischa isabellae* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 138-139, 1908. *All castes.*

Monte Morales, Monte Mandios (W. M. W.); Lares, Yauco, (F. Sein); Las Mesas near Mayagüez (M. R. S.)

This beautiful species is one of the few members of the genus found in Puerto Rico, although the ants are very common in other West Indian Islands, especially Cuba. There seems to be little doubt that *M. isabellae* prefers high elevations for its nesting sites and thrives best in rather densely wooded areas. The ants have been noted at altitudes ranging from about 800 to 3,000 feet. Wheeler found the colonies very small and the ants nesting in a hollow twig and under the roots of an epiphytic orchid. Wolcott records them as nesting in an old stump. I found a colony comprising perhaps 75 to 100 individuals nesting in a branch of a tree in galleries and chambers that may have been previously constructed by some wood-boring beetle. The workers have a habit at times of bending the gaster down-

ward and forward between the legs in a very peculiar manner. When one sees such an ant it immediately gives the false impression that the ant has been unfortunate enough to lose its gaster. Nothing is known concerning the food of the ant, although the species is an arboreal type. Careful examinations of workers from a single colony show that the length of the epinotal spines of this species is highly variable, a point that has much taxonomic significance in reference to the status of several subgenera which have been created for these taxonomically perplexing ants.

Sein took winged males of this ant at Yauco on August 24 I have seen both winged males and male pupae in a nest near Mayagüez on March 15.

The peculiar and beautiful color markings of the worker of this species easily distinguishes it from any other Puerto Rican ant.

34. *Macromischa isabellae mutica* subsp. nov.

Maricao Insular Forest.

Worker: Length 3.5 to 3.7 mm.

Head rectangular, distinctly longer than broad, sides subparallel, posterior border very faintly emarginate, and eyes slightly in front of the middle. Mandibles 5-toothed. Antennal scapes extending a slight distance beyond the posterior angles of the head; segments 3 to 7 of the funiculus apparently broader than long ,the terminal segment as long as the two preceding segments taken together. Thorax considerably less than three times as long as broad; broader in front than behind, and with a straight, transverse carina on the pronotum ending on each side in the angular humerus. In lateral profile the thorax is without sutures and terminates posteriorly in a well-arched epinotum that is devoid of any trace of spines. Petiole from above not more than twice as long as broad, pedunculate, gradually broadening behind; in profile the anterior surface of the node is slightly concave, the posterior surface slightly convex, and the node well rounded and high. Postpetiole, from above, very distinctly broader than long, nearly as broad in front as behind. Gaster small. Legs long, femora incrassated and increasing in size from the first to the third pair.

Opaque; gaster glabrous. Mandibles with coarse longitudinal striations. Clypeus, head, thorax, petiole, and postpetiole very finely and densely punctate, thus giving these parts a velvety appearance. Clypeus, head, and thorax with faint longitudinal rugae, the rugae on the thorax farther apart than those on the head.

Hairs whitish; sparse, more prominent on the head, thorax, petiole, postpetiole, and gaster, more slender and appressed on the appendages.

Head, antennae, coxae, femora, and gaster blue-black. Thorax, petiole, and postpetiole dull orange red; tips of mandibles, tibiae, tarsi, and two elliptical spots at the base of the first gastric segment yellow.

Described from 19 workers collected at the Maricao Insular Forest on August 18, 1935, at an altitude of 3,000 feet. Cotypes in the collections of the United States National Museum and the writer.

The worker of this new subspecies can be distinguished from that of *isabellae* by the following characters:

(1) absence of epinotal spines, hence the specific name, *mutica,*
(2) head with a faintly emarginate posterior border,
(3) petiole not more than twice as long as broad,
(4) thorax lacking considerably of being three times as long as broad, and
(5) petiole with a faint ventral tooth anteriorly.

This new subspecies is of more than ordinary interest in that it sheds considerable light on the taxonomic status of several subgenera formerly proposed for this perplexing group of ants. Roger recognized the variable characters of these ants when he erected the genus *Macromischa* for them, thus indicating by the name of the genus that the species included under it were very diverse, or a large mixture of variable forms.

In 1920 Mann made a very creditable attempt to clarify the situation by taking all the known forms of *Macromischa* and dividing them into three subgenera: (1) those with unarmed epinota and elongated petiolar peduncles, subgenus *Croesomyrmex,* (2) those with rectangular heads and short

peduncles to the petiole, subgenus *Antillaemyrmex*, and (3) those remaining, subgenus *Macromischa* sensu strictu. Wheeler in 1931 went so far as to elevate the subgenera *Croesomyrmex* and *Antillaemyrmex* to distinct genera, although he states that the status of the two is perhaps doubtful "because at least one species of *Macromischa* sensu str., namely *pastinifera* Emery, is terricolous, according to Creighton, and one species of *Antillaemyrmex* (*floridanus*) lives in twigs, and because the species *melanocephala* is very much like an *Antillaemyrmex*, except in the shape of the petiole."

Thus, the finding of the new subspecies *mutica* described above again complicates the situation regarding the forms of *Macromischa* and would seem to indicate that the characters suggested for these subgenera or genera (according to whether one considers Mann's interpretation or that of Wheeler's) are too highly variable and elusive, and it is better, once again, to consider all species of *Macromischa* as belonging to a single genus.

My examinations of many specimens of *M. isabellae* collected from a single colony in Puerto Rico show that the amount of development of the epinotal spines is highly variable among these specimens. The finding of *mutica*, however, shows the absolute futility of retaining the subgenera *Macromischa* and *Croesomyrmex*, since worker specimens of Wheeler's *isabellae* would fall, because of their spined epinotum and slender pedicel, into the subgenus *Macromischa*, and the worker of *mutica*, because of their unarmed epinotum, into the subgenus *Croesomyrmex*. This condition could never exist, since we have here the peculiar anomaly of having the primary form (*isabellae*) falling into one subgenus and that of its variant or derivative (*mutica*) into another subgenus. For these reasons I would propose that all subgenera of *Macromischa* be dropped and all the species in it retained in an undivided genus until a better classification can be provided.

The habits of this new form are so similar to those of the preceding species that they need not to be discussed in detail here. On several occasions the ants have been collected in the Maricao Insular Forest at an altitude of approximately 3,000 ft. Here workers were collected from the surface of the ground and from the trunks of trees as they were foraging singly. Not only do the workers have the same habit of tucking the gaster

beneath the body as with *M. isabellae,* but also when disturbed they crouch down on a surface and remain very quiescent. A small colony was found in the soil beneath a stone. Callows in this nest were noted to carry immature stages around in their mouths, exactly like the fully developed workers.

Nothing is known concerning the feeding habits of these ants.

Fig. 10. *Macromischa albispina* Wheeler (After Wheeler.)

35. *Macromischa albispina* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 139-140, 1908. *Worker, Queen.*

Culebra (W. M. W.)

This species has been taken only once in the West Indian Islands, and that time from Culebra, a small Island off the southeast coast of Puerto Rico. It was described in 1908 by Wheeler from specimens taken nesting "in a small cavity in the ground in the shade of a thicket, where some of the workers were moving about slowly over dead leaves and twigs."

Very little is known of biology of this ant, except that the colonies are small and inhabit the soil. It is inferred that the workers are flesh feeders.

The worker is characterized by a general blue-black body color and very distinctly white epinotal spines. The color of the latter suggested the very typical specific name *albispina.*

36. *Macromischa albispina* subsp. *pallipes* Mann.

Bull. Amer. Mus. Hist., Vol. 42, p. 424, 1920. *Worker, Queen*

Mona Island (Mann)

First described by Mann from Mona Island of the coast of Puerto Rico as a variety of *M. albispina,* this ant was later raised to subspecific status by Wheeler. The latter states that the worker and queen of *pallipes* are smaller than those castes of the species. He also remarks that the worker of *pallipes* has the legs, antennal scapes, and mandibles yellowish white, and petiolar node distinctly smooth and shining. The antennal funiculi are slightly brownish.

The biology of *pallipes* is very probably similar to that of the species.

37. *Rogeria curvipubens* Emery.

Bull. Ent. Soc. Ital., Vol. 26., p. 54, 1894. *Worker Queen.*

Ensenada (M. R. S.)

I have referred to this species a single specimen that was captured from the soil beneath a rock in a dry pasture of one of the most arid areas of the Island. Although I hunted assiduously for other specimens, none could be found.

R. curvipubens has also been collected in the Bahamas, Cuba, and the Virgin Islands. It is apparently a rare ant on the western end of the Island of Puerto Rico.

Nothing is known of the biology of this ant, but it is believed that it forms very small colonies, is subterranean in habits, and is largely a flesh feeder.

The worker, which is less than 2 mm. in length, is of a dark reddish-brown color. The antennae are 12-segmented, the clypeus carinate, the eyes extremely small, the epinotum bispinose. I could not detect any spurs on the hind tibiae. The affinities of this ant seem to lean strongly to those of *Stenamma.*

38. *Tetramorium guineense* Fabr.

Entom. Syst., Vol. 2, p. 357, 1793. *Worker.*

Culebra (W. M. W.); Hatillo, Humacao (H. L. D.); Yabucoa (G. N. W.); Mayagüez, Mani Beach near Mayagüez (M. R. S.)

This introduced species is undoubtedly much more widely distributed in Puerto Rico than the above records would indicate. One would expect to find the ants most commonly in the towns, especially those that are seaports. *T. guineense* is also very widely distributed throughout many of the other West Indian Islands. Several colonies of this species became established in one of our insectaries and gave considerable trouble by feeding on the larvae and pupae of the West Indian fruit fly, as well as some of the other insects. I found a colony of this ant nesting in a rotten coconut log near the beach. Winged males were noted in this nest on September 17. Colonies of this ant apparently do not number over several hundred individuals. The workers feed on flesh as well as on honeydew. On a number of occasions they have been taken from cow dung. Although this species has not been noted infesting houses in Puerto Rico, there is little doubt that it would if the opportunity were given. Wheeler records it as feeding on a broken papaya.

The very coarse, rugose-reticulate sculpturing of the head, thorax, petiole, and postpetiole of the worker, and its larger size, help to distinguish it from the worker of the following species of *Tetramorium.*

39. *Tetramorium lucayanum* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 21, pp. 100-101, 1905. *Worker.*

Mayagüez, 4 miles from Mayagüez (M. R. S.)

This species, first described by Wheeler from specimens taken in the Bahamas, has since been taken from Cuba and Haiti and will probably be found to occur in many of the other West Indian Islands.

Mann records this species as nesting in the soil in small colonies beneath stones. I found a colony of *lucayanum* nesting beneath the bark of an old guaba stump very near the base, in a coffee grove, only a few miles from Mayaguez. Specimens of this ant have also been collected from a crack in the concrete floor of a barn on the Puerto Rico Agricultural Experiment Station grounds. *T. lucayanum* is probably the only species of the genus that is native to the island. Almost nothing is known of the biology of this ant. It is believed that the workers feed mainly on flesh.

The worker is distinguished from those of the other members of the genus here mentioned by its very characteristic, quadrangular (when viewed in lateral profile) petiole ,its black, shining body, and its size (2.25-2.5 mm.).

40. *Tetramorium simillimum* Nylander

List Brit. Animals, Brit. Mus., part 6, p. 118, 1851. *Worker* Culebra (W. M. W.); Coamo Springs (W. M. W.); Lajas, Guayama, Ponce, Sabana Grande (H. L. D.); Tres Hermanos, Mayaguez, Ensenada (M. R. S.)

This introduced species is very commonly distributed throughout many of the West Indian Islands and is perhaps much more widely distributed in Puerto Rico than the above records would indicate. Workers have been collected on a number of occasions from cow dung in pastures in the very dry areas of the Island, also on sandy beaches in the more moist areas. The ants are capable of nesting in the soil or in wood. The workers are thought to be highly predacious, although they attend honeydew-excreting insects to some extent.

The worker can be distinguished from that of the other members of the genus by its very small size, and by the short, distinctly clavate hairs on the thorax, the very short epinotal spines, and the feebler sculpturing of the body.

Fig. 11. *Wasmannia auropunctata* Roger (After Wheeler.)

41. *Wasmannia auropunctata* Roger.

Berl. Ent. Zeitschr. Vol. 7, p. 182, 1863. *All castes*

Culebra (W. M. W.); Utuado, Monte Morales, Monte Mandios, Adjuntas, Coamo Springs, El Morro at San Juan, Vega Baja (W. M. W.); Ciales (Van Z.); Quebradillas (G. N. W.); Guánica (H. L. D.); Río Piedras (J. D. M.); 14 kilometers northeast of Ponce, Lajas, Lares, San Sebastian, Arecibo, Juana Díaz (M. R. S.)

This ant, which is known as the "albayalde" by the natives, is one of the most common of all the Puerto Rican ants. It is also very generally distributed throughout the West Indies. The natives claim that the sting is dreaded by them even more than that of the "hormiga brava" because it is much more lasting. Also, owing to the small size of the workers, the ants can conceal themselves in one's clothing and not be so easily detected. Colonies are very populous and may be found either in the soil or in rotten logs and stumps. Although the "albayalde" is one of the most common ants in densely shaded areas such as coffee groves, it also occurs in open pastures, sandy beaches, etc., and lives in the very arid regions of the Island as well as in the more moist areas.

As an attendant on honeydew-excreting insects the ant is scarcely surpassed, unless it be by the "hormiga brava." Workers have been noted on numerous occasions attending the green and hemispherical scales; the mealybugs *Pseudococcus brevipes, Ps. sacchari* Ckll., and *Ps. virgatus* Ckll.; and the aphids *Toxoptera aurantiae, Sipha flava,* and *Pentalonia nigronervosa.* Their food probably consists of a great deal of flesh also. Van Zwaluwenberg is the authority for the statement that this ant often kills out and displaces colonies of the "hormiguilla" *Myrmelachista ramulorum* Whlr., in coffee groves. On March 18, male and queen pupae were found in a colony.

The small worker is recognized by its prominent antennal scrobe which not only extends to the posterior border of the head but is bordered laterally just above the eyes by a carina; the very prominent, angular, thoracic humeri; and by the elongate, acute, epinotal spines; as well as by its general light yellowish-brown color.

42. *Strumigenys eggersi* Emery.

Bull. Soc. Ital., Vol. 22, p. 32, 1890. *Worker, Queen.*

Juana Díaz (J. W. Balock); Mayagüez, Maricao Insular Forest (M. R. S.)

S. eggersi does not seem to be as common a species in Puerto Rico as *S. rogeri* or *S. louisianae* var. *obscuriventris.* The species is also recorded from Cuba and the Island of St. Thomas.

A dealated queen was taken from the soil beneath a rock in the Maricao Insular Forest at an altitude of 3,000 feet. Balock found a colony comprising about 30 individuals in a pod beneath cow dung in a dry pasture area at Juana Diaz. A winged queen was noted in this nest on January 31. The colonies of *S. eggersi* are very small, consisting of only a few dozen individuals. Absolutely nothing is known concerning the feeding habits of the ants. Kennedy, who made a study of the mouth parts of one species of *Strumigenys* in the United States, was led to infer that their food might be fungi.

The small worker (1.25-1.3 mm.) of this species is easily recognized by its elongate, slender, subparallel mandibles which have 6 to 7 minute denticles on their inner apical borders; and also by the very broad postpetiole, which is several times as broad as long.

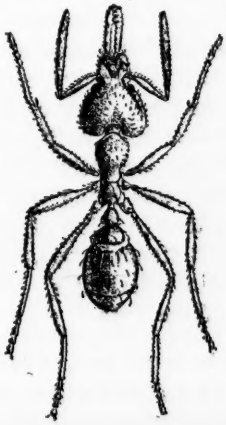


Fig. 12. *Strumigenys rogeri* Emery (After Wheeler.)

43. *Strumigenys rogeri* Emery.

Berl. Ent. Zeitschr., Vol. 7, pp. 253-254, 1862. *Worker*
Coamo Springs (W. M. W.); Arecibo, Mayagüez (M. R. S.)

This is apparently one of the most common species of *Strumigenys* in Puerto Rico and the other West Indian Islands.

Wheeler found this ant nesting in the soil under stones in a nearly dry stream bottom. I have collected the ants from colonies in a stump in a rather densely shaded coffee grove, from the soil at the base of a tree in a coffee grove, and from the soil beneath a stone near a small stream. What has been said about *S. eggersi* with regard to the size of colonies and possible food may also be applied to this species.

The worker of *rogeri*, which is 1.6 mm. in length, can be distinguished from the workers of other members of this genus by its cordate, deeply emarginate head; elongate mandibles, with two prominent subapical teeth on the inner border of each mandible before the apical teeth, and by the erect infraspinal laminae on the epinotum of the thorax.

44. *Strumigenys membranifera* subsp. *simillima* Emery.

Bull. Soc. Entom. Ital., Vol. 22, p. 69, 1890. *Worker*

Lajas (H. L. D.)

A single specimen of this ant, a worker, was collected by Dozier from a clump of rather dry cow dung in a dry, arid pasture. The species has not been recorded from any of the other West Indian Islands except St. Thomas, from which it was originally described. Recently the species was recorded by me from Mississippi, this being the first time that it was noted in the United States. In Mississippi the species commonly nests in the soil beneath stones, wood, or debris. Colonies consist of only a few dozen individuals. Nothing is known about the food preferences of the ants.

The worker, which is 1.5 mm. in length, is characterized by the peculiar shape of its head which is distinctly rectangular anteriorly, by the coarse punctate sculpturing of the head, the small, triangular shaped mandibles, etc.

Fig. 13. *Strumigenys louisianae obscuriventris* Wheeler (After Wheeler.)

45. *Strumigenys louisianae* var. *obscuriventris* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 24, p. 145, 1908 *Worker*

Utuado, Coamo Springs (W. M. W.); Ensenada, Mayagüez (M. R. S.)

Colonies of this ant have been found nesting in the soil beneath stones. At Ensenada the ants were collected from a dry pasture in one of the most arid sections of the island. Isolated workers have also been collected from rather densely shaded moist areas. Undoubtedly the species is highly adaptable to conditions of varying moisture and temperature. What has been said about the biology of the preceding species will also apply to this variety.

Wheeler, who described the variety *obscuriventris* from Puerto Rican specimens, states that it differs from the typical species "in having the gaster, except at the base, dark brown or black, and the ferruginous tint of the body in general darker." The worker is recognized by its elongate mandibles, the inner preapical border of which has a single tooth just before the apical teeth, and by the very distinctly squamiform hairs of the head, as well as by its size (2.25 mm.)

46. *Epitritus emmae* Emery

Bull. Soc. Ent. Ital., Vol. 22, p. 33, 1890. *Worker*

Arecibo, Ensenada (M. R. S.)

Originally described from St. Thomas, this species has not been recorded from any of the other West Indian Islands except Puerto Rico and Cuba.

On one occasion two workers of this species were found nesting in the soil beneath a stone in an open pasture in one of the most arid areas of the Island. At Arecibo a single specimen, a worker, was found in the soil beneath a clump of Bermuda grass at the edge of a pineapple field. The colonies are undoubtedly very small, like those of *Strumigenys*. Nothing is known of the food habits of this species.

The worker is characterized by its 4-segmented antennae, the rectangular-shaped anterior section of its head, the squamiform hairs on the head, and its small size (1.25 mm.)

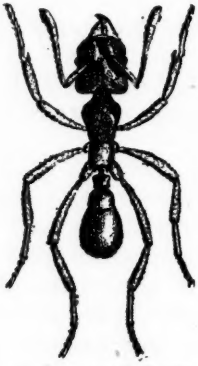


Fig. 14. *Myrmicocrypta brittoni* Wheeler. (After Wheeler.)

47. *Myrmicocrypta brittoni* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 23, pp. 728-729, 1907. *Worker.*

Santurce (W. M. W.)

This species of fungus ant was described from specimens taken in Puerto Rico and has not yet been recorded from any of

the other West Indian Islands. I have not been fortunate enough to collect the species, hence know nothing concerning the nesting habits and biology of the ant.

The worker of this species, which is monomorphic, has the frontal carinae very close to each other and dilated at the anterior extremity, the clypeus not distinctly prolonged between them; and the integument bristling with tubercules and spines, with hooked and scale like hairs.

48. *Cyphomyrmex rimosus* subsp. *minutus* Mayr.

Verh. Zool. Bot. Ges. Wien., Vol. 12, p. 691, 1862. *Worker*

Culebra (W. M. W.); Arecibo, Adjuntas, Utuado, Monte Mandios, Monte Morales, Coamo Springs (W. M. W.); Hatillo, San German (H. L. D.); Rio Piedras, Cayey (G. N. W.); Ponce, Lajas, Mayaguez, Juana Díaz (M. R. S.)

This small fungus ant is not only a common species in Puerto Rico but it is abundantly distributed throughout many of the other West Indian Islands. I have found colonies of *minutus* nesting in rotten stumps and logs and in the soil beneath stones. Apparently the species is adapted to living in both arid and moist regions of the island. The colonies are very small, comprising only a few dozen individuals. Dozier on a number of occasions has collected the workers from cow dung. The worker of this ant, because of its small size and resemblance in color to the soil, is not always easy to see, and furthermore the ants have the habit of feigning death. Their food consists of yellowish, pear-shaped bodies of fungus. They may also eat flesh.

Fig. 15. *Mycocepurus smithi* Wheeler (After Wheeler.)

Madden found workers which he thought were feeding on nymphs of the mole cricket, *Scapteriscus vicinus*.

The monomorphic worker is distinguished by its prominent antennal foveae, scale-like hairs of the body, well-separated frontal carinae, etc.

49. *Mycocepurus smithi* var. *borinquenensis* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 23, p. 718, 1907. *Worker*
Vega Baja, Arecibo, Utuado, Monte Mandios, Coamo Springs (W. M. W.); Mayaguez, San Sebastian (M. R. S.)

This variety of fungus ant, which was described from Puerto Rican specimens, has not yet been recorded from any of the other West Indian Islands except Cuba. The colonies, which are very small, nest in the soil. The entrance hole to their nest is small and more or less obscured by the earth thrown over and around it. The workers superficially bear a resemblance in size, color, and opaqueness to those of certain species of *Pheidole* of the *flavens* group. The ants are not uncommon in the western end of the island and have especially been noted in red clay soil, but may occur in other types of earth.

The worker is characterized by having the frontal carinae close to each other and dilated anteriorly, the petiole with four teeth dorsally, the postpetiole with a deep impression dorsally, and the gaster bordered on each side by a carina.

50. *Trachymyrmex jamaicensis* André.

Rev. d'Entom., p. 149, 1893. *Worker*
Culebra (W. M. W.)

This fungus ant has also been recorded from Cuba and Haiti. I have not been fortunate enough to collect it in the main island. Mann, who studied the habits of this species in Haiti, states that the colonies are rather large. He found them nesting in the plain as well as in other localities which were more humid. In every case the nest was shaded. According to him the workers are diurnal but prefer the late afternoon for foraging. The food of these ants consists of a fungus which grows from a substratum made of leaves, buds, and other vegetable substances.

KEY TO THE SPECIES OF THE FAMILY DOLICHODERINAE.

(*for the identification of workers*)

1. Scale of petiole either vestigial or absent ---------- 2
   Scale of petiole more or less inclined, but well developed 3
2. Antennal scapes surpassing the posterior border of the head; head and thorax dark, gaster light--------
   Tapinoma melanocephalum Fabr.
   Antennal scapes not reaching the posterior border of the head ---------- *Tapinoma littorale* Whlr.
3. Epinotum with a sharp and pointed conical elevation--
   Dorymyrmex pyramicus var. *niger* Perg.
   Epinotum without a conical elevation, but with a gibbous protuberance dorsally ---------- 4
4. Head and thorax honey-yellow -------- *Iridomyrmex melleus* Whlr.
   Head and thorax fuscous ----- *Iridomyrmex melleus* var. *fuscescens* Whlr.

SUBFAMILY DOLICHODERINAE

51. *Tapinoma melanocephalum* Fabr.

Entom. System., Vol. 2, p. 353, 1793. *Worker*

Culebra (W. M. W.); Arecibo, Utuado, Ponce, Taliaboa (W. M. W.); Río Piedras (J. D. M.); Mayagüez, Guánica, Lajas, Tres Hermanos, Lares (M. R. S.)

This ant is not only common in Puerto Rico but is widely distributed throughout the Islands of the West Indies. It is quite versatile in its nesting habits, colonies occurring in the soil beneath stones, under the bark of trees, in hollow twigs, cavities, etc., of plants or trees, and also in rotten logs and stumps. Colonies are sometimes found nesting between the leaves of Tillandsias. Colonies appear to be moderately populous. There are many queens to a nest. The workers are highly predacious as well as lovers of honeydew. They have been noted attending the pineapple mealybug, the green scale, etc. The workers have given repeated trouble by invading insectaries and stealing the insects being reared therein. The ant is an inveterate house-attending form, sometimes even nesting in the house. The very small workers run along at a very rapid, erratic pace. When against a dark surface they give the appearance of a large mite. Workers have the peculiar "Tapinoma odor" characteristic of this group of ants. In Puerto Rico the

ant is commonly known as the "albaricoque", and in Cuba as the "hormiga boticaria", both names of which apply to the peculiar odor of this insect.

The worker is distinguished from that of the other species of *Tapinoma* here mentioned by its long antennal scapes, which exceed the posterior margin of the head, and by its distinctive color, the head and thorax being dark brown and the gaster whitish.

52. *Tapinoma littorale* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 21, p. 109, 1905. *All castes.*

Monte Morales, Monte Mandios (W. M. W.); Doña Juana (H. L. D.); Maricao, Maricao Insular Forest, 14 kilometers east of Mayagüez (M. R. S.)

This species is apparently not so common as the preceding one, having been recorded to date only from the Bahamas, Cuba, and Santo Domingo. Wheeler's name *littorale* has not proved very distinctive for this species in Puerto Rico as neither he nor I have been able to find it elsewhere than away from the beaches, usually on mountains or hillsides. In every instance so far, the colonies of this ant have been collected from plants or trees where they have been nesting in hollow twigs or stems, in crevices between leaves, etc., indicating that the species is mainly if not altogether arboreal. In Puerto Rico the species has been taken most commonly at high altitudes of 3,000 feet or more. Little is known of the food habits of the ants, but it is inferred that they are probably given largely to attending honeydew-excreting insects. Dozier found workers attending a flat, black scale (*Lecanine*) on a palm at an altitude of 3,000 feet. When running over plants outdoors the species is very apt to be mistaken for *Brachymyrmex heeri*, which it closely resembles in size and color.

The small size of the worker (1.25-1.5mm.), its short antennal scapes (not attaining the posterior border of the head), and its generally pale- yellow color, with occasionally an infuscation dorsally, serve to distinguish the worker of *littorale* from that of *melanocephalum*.

Fig. 16. *Iridomyrmex melleus* Wheeler. (After Wheeler.)

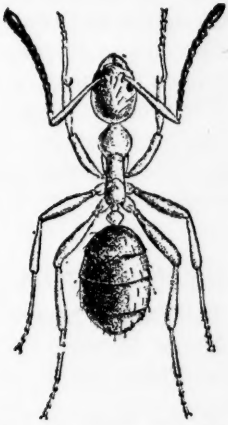


Fig. 17. *Iridomyrmex melleus* Wheeler. (After Wheeler.)

53. *Iridomyrmex melleus* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 151-153, 1908. *All Castes.*

Arecibo, Utuado, Monte Morales, Monte Mandios, Coamo Springs, Vega Baja (W. M. W.); Guayama (J. D. M.); Corazal, Aibonito (G. N. W.); Yauco, Las Marías, Mayagüez, San Germán, Maricao Insular Forest (M. R. S.)

This species, which was described from Puerto Rican specimens, has not yet been collected from any of the other West Indian Islands. This ant is extremely common and is apparently almost entirely confined to the mountains and hills; generally the species is found nesting in hollow twigs of trees or in crevices under the bark, between the leaves of Tillandsias, in rotten logs or stumps, in cocoons of the moth *Megalopyge krugii* Dewitz, and sometimes constructing a carton-like material over its nest on leaves. On one occasion, which was a very exceptional one, a colony was found nesting in the soil beneath a stone. The colonies are moderately populous. The workers are arboreal in habit and given to attending honeydew-excreting insects. They have been noted attending a mealybug, *Pseudococcus sp.*, on Tillandsias, the green and hemispherical scales on coffee, and the plant louse *Toxoptera aurantiae*. When

alarmed the workers can run very rapidly. I have not been able to detect any odor about the workers as with some of the other species of *Iridomyrmex*. Winged males and queen pupae were noted in a nest on August 1.

The worker, which is from 2.0 to 2.25 mm. in length, is distinguished by its slender, graceful appearance; general honey-yellow colored body, with infuscated gaster. All of the antennae, except the scape and first segment, are infuscated.

54. *Iridomyrmex melleus* var. *fuscescens* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol. 24, p. 153. 1908. *Worker*

Monte Morales, Monte Mandios (W. M. W.); Maricao Insular Forest (M. R. S.)

In the Maricao Insular Forest I found this species very common at an altitude of approximately 3,000 foot where colonies were noted quite frequently back of where the axil of the leaf sheath attaches to the trunk of the Sierra Palm, *Euterpe globosa Gaertn.* Other colonies were found nesting under the same conditions as the species. Apparently the habits of the two forms are too similar to warrant further remarks.

The worker bears a striking superficial resemblance to that of the Argentine ant, *Iridomyrmex humilis* Mayr, in both size and color, and in its habit of running around very rapidly.

The worker of *fuscescens* is distinguished from that of *melleus* by its more fuscous body and appendages, with black gaster, yellowish mandibles, and whitish tarsi.

55. *Dorymyrmex pyramicus* var. *niger* Perg.

Proc. Cal. Acad. Sci., Vol. 5, p. 871, 1895. *Worker*

Santurce, Arecibo, Utuado, Adjuntas, Ponce, Aibonito, Coamo Springs, Vega Baja (W. M. W.); Boqueron (H. L. D.); San Germán, Tres Hermanos, Ensenada (M. R. S.)

This dark variety of the so-called "lion ant" has been recorded from the Bahamas, Cuba, Jamaica, Haiti, and Santo Domingo. Its nests are crater-shaped affairs constructed in rather open, sunny places. I have noted the ants in some of the driest areas of the island as well as in the more moist localities. Wheeler states that the ants nest in sandy areas, which

is true, but the species also nests in clay soils. Colonies are not very populous, usually containing only a few hundred individuals. Workers feed on both flesh and honeydew. Workers have the peculiar "Tapinoma odor" characteristic of this ant and some of the other Dolichoderine ants.

The worker can be distinguished from other closely related forms by its very distinctive cone-shaped epinotum, its long maxillary palpi, and very dark color.

KEY TO THE SPECIES OF THE SUBFAMILY FORMICINAE

(*for the identification of the workers*)

1. Antennae with 9 segments ---------- 2
   Antennae with more than 9 segments ---------- 5
2. Last segments of the antennae forming a differentiated club; arboreal species ---------- 3
   Not as above ---------- 4
3. Length 1.75 to 2.3 mm.; second funicular segment broader than long--- *Myrmelachista ramulorum* Whlr.
   Length 2.3 to 2.6 mm.; larger and stouter; second funicular segment longer than broad---------- *Myrmelachista ramulorum* var. *fortior* Whlr.
4. General body color yellowish, or yellowish brown---- *Brachymyrmex heeri* Forel
   General body color brownish black --- *Brachymyrmex heeri* var. *obscurior* Forel
5. Workers monomorphic ---------- 6
   Workers polymorphic ---------- 10
6. Antennal scapes very greatly surpassing the posterior border of the head, apparently twice the length of the head or more; body slender and graceful----- *Paratrechina longicornis* Latr.
   Characters not as above ---------- 7
7. Eyes extremely small, with apparently only 7 or 8 ommatidia; color pale yellowish brown-------*Prenolepis* (*Nylanderia*) *microps*, sp. nov.
   Eyes much larger, with many more ommatidia; color darker ---------- 8
8. Mesopleurae opaque, due to the dense pubescence covering it-----*Prenolepis* (*Nylanderia*) *fulva* Mayr.
   Mesopleurae smooth and shining---------- 9
9. Mesonotum with four macrochetae; all the body and appendages reddish brown, gaster darker ------ *Prenolepis* (*Nylanderia*) *steinheili* Forel
   Not as above-*Prenolepis* (*Nylanderia*) *vividula* Mayr.

10. Head of major worker light red anteriorly; with pale spots often on first and third as well the second gastric segment; minor worker usually with spots only on the second segment. Head, thorax, and gaster of both major and minor workers dark brown, smooth and shining--*Camponotus sexguttatus* Fabr.

Color light yellowish brown, with the head and segments of the gaster often infuscated ---------- *Camponutus ustus* Forel.

SUBFAMILY FORMICINAE

56. *Brachymyrmex heeri* Forel

Denkschr. Schweiz. Ges. Naturw., Vol. 26, p. 91, 1874. *Worker.*

Culebra (W. M. W.); Santurce, Utuado (W. M. W.); Maricao Insular Forest, Mayagüez, Lajas, Las Marías, Juana Díaz (M. R. S.)

This minute species appears to live by preference in such habitats as coffee and citrus groves or well-shaded woods, although the ants are sometimes noted in open areas. The very small colonies, comprising only a very few hundred individuals, are found in the soil beneath objects or also even in rotting logs and stumps. The workers are exceedingly fond of honeydew and have commonly been observed attending the green and hemispherical scales, mealybugs on guaba believed to be *Pseudococcus virgatus* Ckll., the pineapple mealybug, and the aphids *Pentalonia nigronervosa* and *Aphis spiraecola* Patch. I have seen them attending the hemispherical scale along with workers of *Wasmannia auropunctata.* Winged queens were noted in a colony on February 14.

The worker is easily distinguished by its small size, its 9-segmented antennae, and its yellowish to yellowish-brown color.

57. *Brachymyrmex heeri* var. *obscurior* Forel

Trans. Ent. Soc. Lond., p. 345, 1895. *All castes.*

Santurce, San Juan (W. M. W.); Hatillo, San Germán (H. L. D.); Arecibo, Juana Díaz, Lajas, Ensenada, Mayagüez, Hormigueros, Tres Hermanos (M. R. S.)

This dark variety of *B. heeri* is not only a very common

ant in Puerto Rico but it is widely distributed throughout the West Indies. The ants form rather small colonies in the soil or in rotting logs and stumps, nesting by preference in more open areas than the preceding species. The ants if anything, apparently exceed *B. heeri* workers in their love for honeydew. They have been observed attending such economic insects as the green and hemispherical scales, and the aphids *Sipha flava* on sugar cane, *Pentalonia nigronervosa* on bananas and plantains, and *Aphis spiraecola* on citrus. As an attendant on the pineapple mealybug in Puerto Rico this ant is only excelled by the "hormiga brava". The workers must feed largely, if not almost exclusively, on honeydew. I have actually seen workers of this species with apparently uninjured and healthy pineapple mealybugs in their mouths.

The worker is recognized by its short, robust form, its 9-segmented antennae, and its very dark brown color.

58. *Prenolepis* (*Nylanderia*) *fulva* Mayr.

Verh. Zool. Bot. Ges. Wien., Vol. 12, p. 698, 1862. *Worker, Queen.*

Humacao (Van Z.); Isabella (L. C. F.); Arecibo (M. R. S.)

This species has been recorded from Cuba, Haiti, and Santo Domingo. Apparently the species prefers to nest in more open areas than in the woods or well-shaded spots. Workers are exceedingly fond of honeydew and have been noted attending the following important economic insects; *Pseudococcus sacchari* on sugar cane, *Aphis gossypii* on cotton, and the pineapple mealybug on pineapple. A worker was noted transporting a pineapple mealybug in its mouth at Arecibo. Other workers had greatly distended gasters, indicating that they had just fed on large quantities of honeydew. On the western end of the Island *P. fulva* does not appear to be as common or as widely distributed as some of the other species of *Prenolepis*. The ants are believed to nest principally in the soil in moderately small colonies. Workers when alarmed are able to run very fast.

The worker of this species is distinguished from those of other *Prenolepis* by its larger size, robust appearance, the deep brownish color and opaqueness of the body, as well as its very

long and large pilosity. There are more macrochetae on the mesonotum than with the species *steinheili* and *antillana*.

59. *Prenolepis* (*Nylanderia*) *vividula* Nyl.

Acta. Soc. Fennica, Vol. 2, p. 900, 1846. *All castes.*

Culebra (W. M. W.); Monte Mandios, Monte Morales, Utuado (W. M. W.); Maricao (G. N. W.)

I have not taken any specimens of *Prenolepis* which I could definitely refer to this species. The variety *antillana* is very commonly distributed throughout the West Indies. One would expect to find the ants nesting in small colonies in the soil beneath objects and also in logs and stumps. Wolcott records the ants as nesting in the stem of a banana plant at Maricao.

Not having seen specimens which I am positive belong to this species, it is impossible for me to characterize it.

60. *Prenolepis* (*Nylanderia*) *steinheili* Forel

Trans. Ent. Soc. London, p. 324, 1893. *Worker*

Adjuntas, Santurce (W. M. W.); Lajas, Mayagüez, Maricao Insular Forest (M. R. S.)

Specimens of what I believe to be this species were collected from a colony in rich, mucky soil beneath a stone at the top of the Maricao Insular Forest at an altitude of 3,000 feet. The ants form small colonies in the soil or in rotting wood such as logs and stumps. Workers very probably feed on flesh as well as on honeydew. This appears to be one of the most common species of *Prenolepis* in Puerto Rico. It is also recorded from many of the other West Indian Islands.

The worker is characterized by having four large macrochetae on its mesonotum and the rest of the body is reddish-brown except the gaster, which is a little darker.

61. *Prenolepis* (*Nylanderia*) *microps* sp. nov.

14 kilometers east of Mayagüez (M. R. S.)

Worker: Length, 2 mm.

Head distinctly longer than broad, with very faintly emarginate border, and well-rounded sides and posterior angles.

Mandibles with 6 distinct teeth, of which the apical, the fourth, and the basal teeth are the largest. Antennal scapes very long, exceeding the posterior border of the head by at least one-third their length; first funicular segment small, not very much longer than broad; all the other segments of the antennae very noticeably longer than broad. Eyes extremely small for a *Prenolepis*, oval, with 7 to 8 ommatidia. Thorax strongly depressed in the region of the meso-epinotal region where there is a pair of prominent spiracles. Base of epinotum rounded and apparently only one-third to one-fourth the length of the declivity. Petiole rather thick on its superior border, inclined forward. Legs long and slender.

Extremely smooth and shining, with dark, erect hairs rather abundant over all parts of the body, but especially on the head and gaster. The mesonotum with 8 large macrochaetae. Color pale yellowish brown.

Described from 4 workers collected from the soil beneath a stone in a rather dense woods and not far from the edge of a stream. Cotypes in the collections of the United States National Museum and the writer.

The worker of this species differs from that of Mann's *myops*, to which it is closely related, by the following characters: (1) Difference in the number of mandibular teeth (*myops* has four), and (2) the sides of the head are distinctly convex and not straight.

These ants appear to be strictly subterranean, as is indicated by their pale color, and extremely small eyes. Nothing is known of the ant's biology.

62. *Prenolepis* (*Nylanderia*) *longicornis* Latr.

Hist. Nat. Fourmis, p. 113, 1802. *Worker*

Culebra (W. M. W.); San Juan, Santurce, Arecibo, Utuado, Adjuntas, Ponce, Tallaboa, Coamo Springs (W. M. W.); Yauco, Caguas, Mameys (T. H. J.); Lajas, Ensenada, Mayagüez, Guánica, Tres Hermanos, Lares, Sabana Grande (M. R. S.)

This introduced ant is not only one of the most common ants in Puerto Rico but it is also widely distributed through

the West Indies. From the towns into which it was first imported the ants have later been disseminated into the rural areas, until now the species is so abundant as to give one the impression that it is a native ant. This distribution is not yet uniform even though one often encounters the ants in wooded areas and coffee groves considerably removed from habitations. The workers of this species are known by the native name of "hormiga loco" or ("crazy ant") because of the habit the workers have of often speeding around very swiftly helter skelter without any definite sense of direction. I have encountered the speies on the sandy beaches, in pastures in the driest areas of the island, as well as in moist and densely shaded areas. The workers are exceedingly fond of honeydew and have been observed on numerous occasions attending aphids, scales and mealybugs. They are known to attend the cotton aphid (*Aphis gossypii*), the green scale (*Coccus viridis*), the pineapple mealybug, (*Pseudococcus brevipes*), etc. This is one of the most important house-infesting ants in the island. Workers have been reported digging up lettuce seed and carrying tobacco seeds away from seed beds. Their fairly populous colonies may be found in the soil or in rotting wood.

The worker is easily recognized by its slender, graceful form, black color, and exceedingly long legs and antennae. The specific name, *longicornis*, well applies to the extremely long antennae of this species .

63. *Camponotus sexguttatus* Fabr.

Entom. Syst., Vol. 2, p. 354, 1793. *Worker.*

Culebra (W. M. W.); Fajardo, Morro at San Juan, Coamo Springs (W. M. W.); Loiza Aldea (H. K. P.); Mayagüez (J. S.); Coamo (G. N. W.); Naguabo (F. S.)

The genus *Camponotus* is very poorly represented in Puerto Rico. One of the largest and most beautiful species of this group in the island, however, is the species *C. sexguttatus*. It is apparently not so common on the western end of the island as *ustus*. Wheeler states that "it lives either in hollow twigs of trees and bushes, in bark, or in nests of coarse, loose carton, which it builds around the stems of grasses in savannahs by agglutinating the thread - like particles of grass and other

debris." The carton-like material is also used by the ants for plugging the open holes of twigs, or cavities in plants in the interior of which they nest. Plank found a colony nesting inside the dried fruits of the Frescora tree.

They were also collected by Sepulveda from the rotten roots of a mango tree in which they were nesting. Colonies are not thought to be very populous, probably consisting of only a few hundred individuals. Nothing is known of the ant's food habits. Owing to the variability of the spots in the color markings of these ants, they have been described many times under diverse names.

The characters mentioned in the key to the species will serve to distinguish *sexguttatus* from any other species with which it might be confused.

64. *Camponotus ustus* Forel.

Bull. Soc. Vaud. Sci. Nat. (2), Vol. 16, p. 75, 1879. *All castes.*

Culebra (W. M. W.); El Morro at San Juan, Utuado, Monte Morales (W. M. W.); San Sebastián, Ciales, Lares (G. N. W.); Mayagüez, Maricao Insular Forest, Ensenada (M. R. S.)

This species, which is rather common in Puerto Rico, has also been recorded from Haiti and the Virgin Islands.

Wheeler found the ants "nesting in the hollow twigs of the sea grape, *Coccoloba uvifera.*" In Culebra he noted them nesting in the ground beneath a block of coral. Wolcott records *C. ustus* as being colonized in an old stump, and also in dead twigs of *Inga vera.*

On numerous occasions I have taken the species in the vicinity of Mayagüez, where they were found nesting in stumps, posts, dead branches of trees, etc., in colonies of only a few hundred individuals each. The smaller workers are very fast of foot and secretive. The soldiers can bite rather painfully when cornered.

At Ensenada a colony of the ants was found nesting in a dead branch of a tree in one of the driest and most arid areas of the island. When workers and soldiers were dropped on the

hot ground in full exposure to the sun they ran around frantically for several minutes and then expired. It is believed from this that the ants are crepuscular or night-working forms which do not forage during the daytime.

The amount of infuscation on the head as well as the general color of the body seems to be quite variable.

Fig. 18. *Myrmelachista ramulorum* Wheeler (After Wheeler.)

Fig. 19. *Myrmelachista ramulorum* Wheeler (After Wheeler.)

65. *Myrmelachista ramulorum* Whlr.

Bull. Amer. Mus. Nat. Hist., Vol 24, pp. 155-156, 1908. *All castes.*

Culebra (W. M. W.); Arecibo, Utuado (W. M. W.); Lares, Yauco, Cayey, and Ciales Valley south of Manati (G. N. W.); Mayagüez, 15 kilometers northeast of Yauco, San Sebastian, Maricao (M. R. S.)

This ant, which is known by the local name of the "hormiguilla", was described by Wheeler from Puerto Rican specimens. Since that time the species has been taken in Santo Domingo and the Virgin Islands. Wolcott states that he has observed the species nesting at sea level, and Tulloch has collected specimens from El Yunque at an altitude of 4,000 feet. The distribution of the ant is closely affiliated with that of the plantings of coffee, since the typical Puerto Rican coffee (*Coffee arabica*) is also dependent on much shade and perhaps a high degree of moisture, like the hormiguilla. The hormiguilla

forms numerous colonies in the coffee shade trees, there being few trees that the ants do not nest in. Most of the individuals are to be found in the guama and guaba trees, one reason being that these are two of the most common kinds of shade trees in a coffee grove. On a moderate sized guaba tree I estimated there were 37,100 workers, 89 fertile or mother queens, and 60 winged males, or an average of 415 workers per queen. Since the ants nest inside of the twigs and galls of trees, one has little appreciation of the many, many thousands that may occur in a coffee grove. In one badly infested cuerda I estimated that there were over 5,000,000 ants. Inside of the galls and twigs of guama and guaba especially, and of a few other shade trees, the ants obtain much honeydew from the scale *Cryptostigma inquilina* Newstead, but this is also supplemented by honeydew obtained from such scales as *Coccus viridis* and *Saissetia hemispherica*, the plant louse *Toxoptera aurantiae*, and the mealybug *Pseudococcus nipae* and *P. citri*. In old, badly neglected coffee groves, especially where the guama and guaba trees are allowed to get very large, these ants migrate over into coffee and injure it by tunneling in the branches or trunk, by girdling the tree, or by causing large and unsightly galls. At picking time or during hurricanes the trees are badly injured through breakage resulting from the initial attack of these ants. Males have been seen at lights on numerous occasions, but no winged queens. It is believed that the males fertilize the queens on or in trees without these winged forms having to take the ordinary nuptial flight. Only on one occasion were winged queens and queen pupae encountered in a nest and this on December 13.

The worker is recognized by its 9-segmented antennae, its dark head and gaster with yellowish-red thorax, and its yellowish appendages.

66. *Myrmelachista ramulorum* subsp. *fortior* Whlr.

Bull. Bus. Comp. Zool. Harvard, Vol. 77, pp. 189-190, 1934. *Worker.*

Mona Island (F. E. L.); Puerto Rico (W. M. W.)

This subspecies differs from specimens of the typical *ramulorum*, according to Wheeler, in the following respects,

"in being decidedly larger and more robust; the head larger and broader; joints two to five of the funiculi decidedly longer, the second distinctly longer than broad, the third and fourth as long as broad. Petiolar scale as in the typical form, with entire or very feebly and broadly sinuate superior border. In profile this border is decidedly thicker and blunter; the posterior pedunculate extension of the petiole well-developed as in the typical form. Erect hairs on the body, scapes and tibiae even more numerous and longer. Coloration more vivid, the mandibles and head being deep red, the latter blackish behind, the thorax and appendages of a more reddish-yellow tint than in the typical *ramulorum*." Nothing is mentioned by Wheeler concerning the biology of this form.

In my studies of the hormiguilla in the coffee groves I have noted on frequent occasions considerable difference in the size of workers in various colonies, those in incipient or weak colonies being strikingly small. This I attributed, however, to unfavorable conditions.

BIBLIOGRAPHY

Aguayo, C. G. New Ants of the Genus Macromischa. Pysche, 38; 175-183. 1931.

Notes on West Indian Ants. Bull. Bklyn. Ent. Soc., 27; 215-227. 1932.

Mann, W. M. Additions to the Ant Fauna of the West Indies and Central America. Amer. Mus. Nat. Hist. Bull., 42; 403-439. 1920.

Menozzi, C. Ants of Cuba and Canary Islands collected by Professor F. Silvestri. Bull. Lab. Zool. Gen. Agrar., 23; 1 - 5. 1929.

Contribution to the Knowledge of the Ant Fauna of the Dominican Republic. Bull. Lab. Zool. Gen. Agrar. Portici, 24; 148-173. 1930.

Santschi, F. Ants of Cuba and Panama. Rev. de Entom., 1; 265-282. 1931.

Wheeler, W. M. The Ants of the Bahamas (with a check list of the known West Indian Formicidae). Bull. Amer. Mus. Nat. Hist., 21: 79-135. 1905.

The Ants of the Bermudas. Bull. Amer. Mus. Nat. Hist., 22: 47-352. 1906.

The Ants of Jamaica. Bull. Amer. Mus. Nat. Hist., 24: 159-163. 1908 The Ants of Porto Rico and the Virgin Islands. Bull. Amer. Mus. Nat. Hist., 24: 117-158. 1908.

Additions to the Ant Fauna of Jamaica. Bull Amer. Mus. Nat. Hist., 30: 21-29. 1911.

Ants Collected in the West Indies. Bull. Amer. Mus. Nat. Hist., 2: 239-244. 1913.

The Ants of Cuba. Bull Mus. Comp. Zool. Harvard, 54:477-505. 1913.

Jamaican Ants Collected by Professor C. T. Brues. Bull. Mus. Comp. Zool. Harvard, 61: 457-471. 1917.

Report on the Ants Collected by the Barbados-Antigua Expedition from the University of Iowa in 1918. Univ. of Iowa Stud. in Nat. Hist., 10: 3-9. 1923.

New and Little Known Ants of the Genera MACROMISCHA, CROESOMYRMEX and ANTILLAEMYRMEX. Bull. Mus. Comp. Zool. Harvard, 72: 1-34. 1931.

Wheeler, W. M. and Mann, W. M. The Ants of Haiti. Bull. Amer. Mus. Nat. Hist. 33; 1-61. 1914.

NEW OR LITTLE-KNOWN SPECIES OF WEST INDIAN "TIPULIDAE" (DIPTTRA) L. I.

By Charles P. Alexander

Massachusetts State College, Amherst, Massachusetts

A few interesting new species of crane-flies have been included in various lots of specimens sent to me for identification. The following sources are included: Puerto Rico, through Dr. William A. Hoffman; Cuba, through Professor Stephen C. Bruner and Mr. A. R. Otero; and the Bahamas, through Dr. John G. Myers. Through the friendly interest of the above-mentioned entomologists, I have been privileged to retain the types of the species in my private collection of these flies.

Shannonomyia hoffmani sp. n.

General coloration gray, the praescutum and scutum dark brown; pleura brownish black, sparsely pruinose; wings cream-yellow, sparsely variegated by dark brown areas; cell *R*3 small, vein *R*2+3 being longer than *R*2+3+4; cell 1*st M*2 elongate, closed; abdomen black.

Male.— Length about 5.3 - 5.5 mm.; wing 5 - 5.2 mm.

Rostrum and palpi dark brown. Antennae short; scape, pedicel and basal one or two flagellar segments light yellow, the remaining segments brownish black; verticils exceeding the segments in length. Head gray, the front and anterior vertex clearer and lighter gray.

Pronotum and lateral pretergites clear gray, the latter extending to the wing-root. Mesonotal praescutum and scutum almost uniformly dark brown, the median area of the former darker, the lateral portions more pruinose; scutellum uniformly blackened, sparsely pruinose; mediotergite gray pruinose. Pleura brownish black, sparsely pruinose. Halteres chiefly pale. Legs with the coxae brownish testaceous; trochanters obscure yellow; femora obscure brownish yellow, the tips weakly darkened; tibiae brown, the tips narrowly more darkened; tarsi black. Wings (Fig. 1) with the ground-color cream-yellow,

sparsely variegated by dark brown areas, including spots at arculus; a virtually common area at origin of *Rs*, *Sc*2 and tip of *Sc*1; series of spots along cord and outer end of cell 1*st M*2; small marginal darkenings at tips of all longitudinal veins excepting *R*5, the largest at 2*nd A*; veins yellow, darker in the infuscated areas. No macrotrichia on Rs or its anterior branch; *R*5 with abundant trichia over its entire length. Venation: *Sc* short, *Sc*1 ending about opposite one-third to one-fourth length of *Rs*, *Sc*2 about mid-distance between *Rs* and the tip of *Sc*1; *R*2 about one-half shorter than *R*2+3+4; *R*2+3 longer than *R*2+3+4; cell 1*st M*2 elongate, closed; *m-cu* close to fork of *M*.

Abdomen black, the hypopygium a trifle paler.

Habitat.— Puerto Rico.

Holotype, male, Luquillo National Forest, at light, September 8, 1935 (W. A. Hoffman). Paratopotype, male.

Associated at light with *Shannonomyia leonardi* Alex. and *Erioptera* (*Mesocyphona*) *portoricensis* Alex.

I take great pleasure in naming this distinct crane-fly in honor of my long-time friend, Dr. William A. Hoffman. The only close ally in the West Indian fauna is *Shannonomyia leonardi*, likewise from the Luquillo National Forest. The latter is readily told by the uniform pale yellow coloration of the thorax, together with the brownish yellow abdomen. By my key to the Puerto Rican species of the genus (Journ. Dept. Agr. Puerto Rico, 26: 368; 1932), the species runs directly to *leonardi*.

Teucholabis (*Teucholabis*) *oteroi* sp. n.

General coloration yellow, variegated with black; lateral praescutal stripes bent laterad to margin; knobs of halteres infuscated; femora yellow, each with a single, narrow, pale brown ring immediately before midlength; tibiae uniformly yellow; wings whitish subhyaline, with three pale brown fasciae, the last being the narrow wing-tip; cell 1*st M*2 closed; abdomen yellow, the basal/tergite black, the outer segments restrictedly variegated by brown/areas; the basal areas; male hypopygium with the margin of the basistyle produced into a thin, slightly blackened plate or flange; basistyle not produced at apex.

Male.— Length about 8.5 - 9 mm.; wing 7 - 7.5 mm.

Rostrum, brown, obscure yellow above, slightly shorter than the remainder of head; palpi black. Antennal flagellum black, the scape yellow; pedicel brownish yellow; flagellar segments oval, with conspicuous verticils. Front and anterior vertex blackened, the posterior vertex and occiput yellow, the latter with an inconspicuous darkened triangle.

Pronotum obscure yellow, darker anteriorly above. Mesonotal praescutum yellow, with three black stripes, the median one paling to brown on anterior end, its posterior portion ending abruptly some distance before the suture, leaving a conspicuous yellow area behind it; lateral stripes with anterior ends continued outward to margin of sclerite, isolating a yellow area between them and the suture; median area of scutum pale yellow, the lobes extensively darkened; scutellum weakly darkened; mediotergite obscure brownish yellow. Pleura chiefly darkened, heavily light gray pruinose. Halteres with the stem yellow, the knob infuscated. Legs with the coxae and trochanters obscure yellow; femora yellow, unmarked except for a single, narrow, pale brown ring just before midlength of the segment; tibiae and basitarsi yellow, the outer tarsal segments black. Wings (Fig. 1. 2) whitish subhyaline, with three pale brown fasciae, the first lying before level of origin of *Rs*, extending from vein *R* to the posterior margin; second band chiefly beyond level of cord, extending from the darker brown stigma to the posterior margin, including all of cell 1st M2; third band including the narrow wing-tip; veins yellow, the costal field more brightly so; veins darkened where traversing brown areas. Venation: *Sc*1 ending opposite midlength of *Rs*, the latter moderately arcuated; *R*2+3+4 a little shorter than the slightly oblique *R*2; branches of *Rs* lying approximately parallel to one another to margin, cell *R*2 being nearly three times as extensive at border as is cell *R*4; cell 1*st M*2 closed; *m-cu* shortly beyond fork of *M*.

First abdominal tergite black; outer segments yellow, very vaguely and restrictedly marked with darker, more extensively so on the sternites; hypopygium pale. Male hypopygium with the mesal edge of basistyle thin and weakly blackened, spine of basistyle long, slender, gently curved, the basal half pale and dilated; basistyle not or scarcely produced caudad at outer end. Outer dististyle a gently curved rod that terminates in a simple spinous point.

Habitat.— Cuba (Pinar del Rio).

Holotype, male, Las Animas, Sierra Rangel, altitude 1,500 feet, September 4, 1934 (S. C. Bruner and A. R. Otero). Paratopotype, male.

I take great pleasure in dedicating this interesting species to Mr. A. R. Otero, to whom I am indebted for several interesting species of Cuban Tipulidae. The species is very different from the remaining regional species of the genus in the diagnostic features listed. The nearest ally is the Jamaican *Teucholabis* (*Teucholabis*) *gowdeyi* Alexander, which differs conspicuously in the open cell *M*2 of the wings, the leg-pattern, and the structure of the male hypopygium.

Teucholabis (*Teucholabis*) *portoricana* sp. n.

Closely allied to *T.* (*T.*) *myersi* Alexander, of Cuba and southern Florida (Journ, N. Y. Ent. Soc., 34: 228 - 229; 1926), differing chiefly in the structure of the male hypopygium.

Male.— Length about 5 mm.; wing 5.5 mm.

Female.— Length about 5 mm.; wing 5 mm.

Male hypopygium with the apical spine of basistyle a straight pale rod, terminating in a short acute spine that lies in the same axis as the remainder of the rod. Outer dististyle pale throughout, slender, the spine on mesal margin small, suberect. Inner dististyle with the outer emargination shallow and much shorter than the basal one, the denticle separating them low and obtuse. Aedeagus with the apical point straight, pale throughout.

The male hypopygium of *myersi* has the apical spine of the basistyle large and conspicuous, the basal half dilated, the distal half abruptly narrowed into a long sinuous spine. Outer dististyle darkened throughout, the spine on mesal margin acute, subappressed. Outer dististyle elongate, the two emarginations subequal in size or the outer a trifle more extensive, the median denticle acute. Aedeagus with the apical point curved, blackened.

Habitat.— Puerto Rico.

Holotype, male, El Semille, Villalba, altitude 1,600 feet, at

lighat, January 26, 1935 (W. A. Hoffman). Allotype, female, Paratopotype, sex?

The wing-venation is shown in Figure 3.

Toxorhina (*Toxorhina*) *distalis* sp. n.

General coloration gray, the praescutum with three brown stripes; femora brownish yellow, the tips weakly darkened; tibiae brownish yellow, the tips narrowly brownish black; wings with macrotrichia of veins very sparse; *Rs* unusually long, exceeding in length vein *R*5, due to the position of *r-m* close to outer end of the long cell 1*st* M2; *m-cu* about two- thirds its length beyond the fork of *M*.

Female.— Length, excluding rostrum, 8 mm.; wing 5.5 mm.

Rostrum broken beyond the base, which is dark brown. Antennae with basal segments dark brown; outer flagellar segments broken. Head gray.

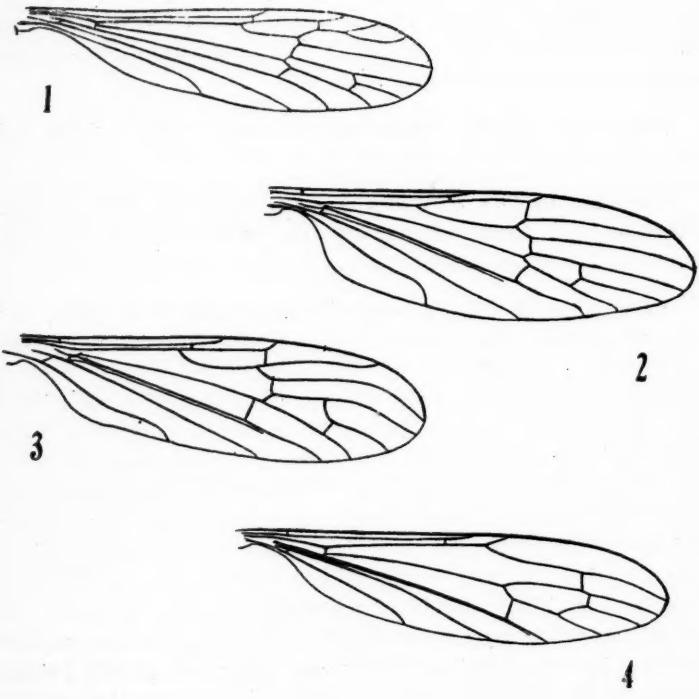
Cervical region dark brown. Mesonotum light gray, the praescutum with three brown stripes, the laterals somewhat less distinct; posterior interspaces weakly infuscated; centers of scutal lobes darkened; scutellum and mediotergite clear light gray. Pleura and extreme lateral margin of praescutum light gray, the ventral sternopleurite somewhat darkened. Halteres pale. Legs with the coxae weakly infuscated; trochanters yellowish testaceous; femora brownish yellow, the tips weakly darkened; tibiae obscure brownish black; tarsi brown. Wings (Fig. 4) with a grayish tinge, the pearcular region light yellow; veins brown. Macrotrichia of veins very sparse, in type with a single trichium near outer fourth of *Rs*; four or five scattered along *R*5; an equal number near outer end of cell 1*st M*2 Venation: Rs unusually long, exceeding *R*5, due to the position of *r-m* far distad, close to outer end of cell 1*st M*2; cell 1*st M*2 present, elongate, exceeding cell 2*nd M*2; *r-m* lying immediately before *m; m-cu* about two-thirds its length beyond the fork of *M*.

Abdominal tergites brown, the caudal and lateral borders, together with a more or less distinct crossband at midlength of the segments restrictedly darker.

Habitat.— Bahamas.

Holotype, female, New Providence, May 1932 (J. G. Myers); Colector's No. 2557.

Toxorhina (*Toxorhina*) *distalis* is very different from all other regional species in the distal position of crossveins *r-m* and *m-cu*, together with the unusually long cell 1*st M*2.



Explanation of figures.

1—*Shannonnomyia hoffmani* sp. n.; venation.

2—*Teucholabis* (*Teucholobis*) *oteroi* sp. n.; venation.

3—*Teucholabis* (*Teucholobis*) *portoricana* sp. n.; venation.

4—*Toxorhina* (*Toxorhina*) *distalis* sp. n.; venation.

THE LIFE HISTORY OF "DIAPREPES ABBREVIATUS" L., AT RIO PIEDRAS, PUERTO RICO.

BY GEORGE N. WOLCOTT,

Entomologist, Agricultural Experiment Station, Río Piedras, P. R.

Less is known about the details of the life-histories of the Otiorhynchid weevils of the genera *Pachnaeus, Prepodes, Exophthalmodes* (or *Exophathalmus*) and *Diaprepes* than of any of the other common and comparatively large insects of the West Indies. This is all the more surprising because some of them are economic pests of primary rank, and at least in Puerto Rico and Barbados at the present time, they appear to be of relatively increasing importance.

The early work of the Rev. Watson on *Diaprepes abbreviatus* in Barbados in 1903 (15) and of Cook & Horne on *Pachnaeus litus* in Cuba in 1908 (3) is based on conclusions drawn from only a few individuals, and later workers have merely added field observations to form a tentative theory of what actually takes place during the subterranean period of development. With many insects, no serious error would be involved, but this group of weevils, and especially *Diaprepes abbreviatus*, displays such a wide variation in practically every aspect of its being that more exact information should be available. Attempts at rearing under close observation from egg to adult were first seriously attempted by the writer in Haiti in 1929, using *Prepodes quadrivittatus* (17), and later were resumed in Puerto Rico using *Diaprepes abbreviatus* (19). The development of a successful rearing technique (21) permitted the completion of a sufficient number of case histories to make possible this final report. Admittedly, the present paper treats of only one species at a single locality, but the determination of what factors are responsible for the wide variation shown by the individuals of this species in a single environment is still so uncertain that it seems desirable to present the data now available, which may serve as a basis for comparison with observations on this and other species in similar or quite different environments.

The diversity of the scientific names of the various members of this group of weevils should not obscure the fact that the insects themselves are fundamentally very similar, and indeed the points on which the genera are distinguished are so difficult to discover that to one species, *quadrivittatus* Olivier of Hispaniola, four generic names (all except *Pachnaeus*) have been applied in recent times by specialists in the nomenclature of Curculionidae. Not only do the systematists effectively fail to note esential differences, but the recent discovery that the egg-parasite, *Tetrastichus haitiensis* Gahan, attacks *Pachnaeus litus* in Cuba (2), *Prepodes quadrivittatus* in Haiti (from which it was originally described: 6), *Diaprepes abbreviatus* in Puerto Rico and *D. famelicus* in Montserrat (11) sufficiently indicates the fundamental similarlity of these beetles as it appears to a specialized insect directly dependant on them for its existence. Moreover, from the standpoint of the farmer, the injury caused by these pests is practically the same everywhere that they occur in abundance, and is a single problem so far as the citrus or cane grower is concerned, regardless of what the entomologist calls the insect responsible.

Rarely are mature citrus trees in groves in Puerto Rico severely injured by the feeding of "vaquitas", as the adults of *Diaprepes abbreviatus* L. are locally called, altho several complaints have been received of injury to large trees. Nurseries and young trees just set out in the grove are much more often attacked, or at least the feeding of the beetles is more obvious to the grower on such small trees. The beetles feed almost exclusively on young tender foliage, altho when exceptionally abundant, they may attack the older leaves. Due to seasonal abundance of the weevils, most of the young foliage may be consumed at one time, while a later flush of growth escapes without commercial injury, but instances have been noted of trees being so repeatedly defoliated that they eventually died. Their death was presumably due to a combination of circumstances, for undoubtedly at the same time the grubs of *Diaprepes* were feeding on their roots. This only serves to emphasize, however, the dual nature of the injury caused by this insect in citrus groves: of the adults to the leaves, and of the grubs to the roots.

Vaquitas feed on the leaves of many other kinds of trees

besides citrus, and, especially in the case of those trees which obtain all their new leaves at the same time, such as the "moca", *Andira inermis*, often completely denude them of their leaves so that they remain defoliated for the remainder of the year. Or trees are sometimes noted that remain practically defoliated despite the constant production of new leaves. Young trees of "ceiba", *Ceiba pentandra*, have been observed with only a comparatively few vaquitas on them, yet even a few beetles (with their numbers constantly renewed as the older ones disappear) eating only the yong leaves succeed in keeping the foliage permanently ragged.

Solitary vaquitas are found, especially in cane fields, but the adult weevils are essentially social in their habits. Dozens are often to be seen congregated on the young growth of small trees, and large trees being denuded of a flush of tender growth may harbor thousands at one time. For no ascertainable reason, particular trees are often preferred by the beetles to others of the same kind nearby, and even tho the beetles are free to move about and fly to others, they often remain congregated on such trees for weeks at a time. If disturbed by the presence of man, some individuals drop to the earth and crawl away between the vegetation, or, if on bare earth, clumsily run for cover. Others drop, but take flight before reaching the ground, while others clamber to a more protected situation on the host, or fly from it. In captivity, one continually hears the sound of their dropping to the bottom of the can, and presumably dropping to the ground is a common, natural habit, even when not disturbed.

The beetles apparently feed at all times of the night and day, but many are merely resting in the company of others, while numerous pairs are to be observed in coitu. In confinement, the elytra of the males often become densely covered with excrement, but in nature they remain clean and immaculate. Sometimes solitary vaquitas are attracted to lights at night, even as high as the second story of houses, and presumably they fly as readily at night as in the daytime.

The feeding of the beetles, for the most part, is due to the requirements of the female in the production of eggs, dropping off rapidly when she has ceased to oviposit, while that of the males is insignificant by comparison. The female during oviposition eats her own weight of food in a day. This is hardly

surprising considering that during her life-time she lays eggs sometimes weighing four or five times as much as she herself weighs. The eggs represent much more concentrated energy than do the tender leaves, which explains the tremendous demands of the female, depending on such innutrituous food, if she is to produce them.

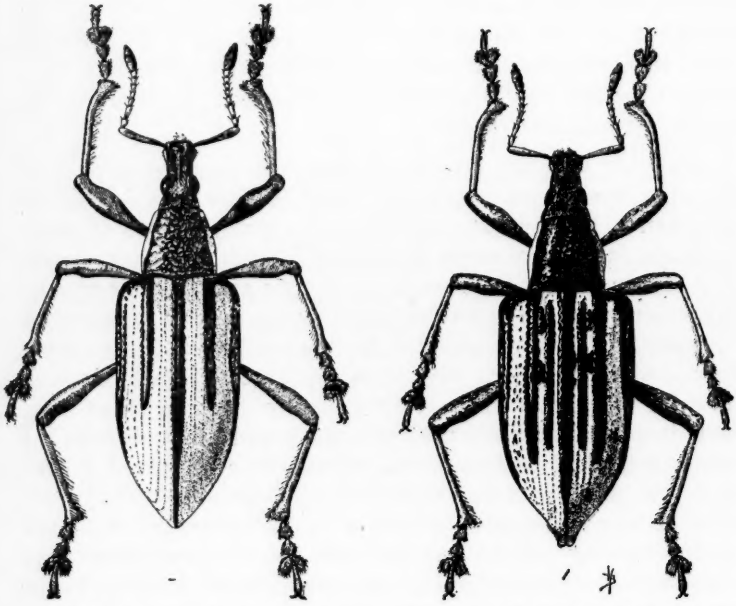


Fig. 1. Adults of *Diaprepes abbreviatus* L., five times natural size. (After Pierce.)

In captivity, adults live four or five months after they have transformed from the pupa, but often half of this time is spent below the surface of the ground. After the adult emerges from the ground, it never returns to burrow into it. Some adults live much longer than do others, the maximum number of days being 336, 295 and 262 for three females, and (rather doubtfully) 323 days for a male. The average is much less than this, however, for sixteen males being 123 days and for thirteen females 160 days.

The period of activity of the adults above ground is much less, averaging less than two months for all the males observed,

but over four months for the observed females, apparently indicating that the males spend considerably more than half of their shorter adult life below the surface of the ground, and the females very much less of their total time thus inactive. The females have a very definite objective in living: oviposition, which occupies all of their aerial adult life from less than a week after emergence from the soil until a slightly longer period after the final egg-cluster is laid. They are very tenacious of life (in captivity), and altho not at all active in old age, may yet survive for several days after becoming too weak to crawl about. Rarely do the males show any such gradual decay of their faculties, being apparently normally active one day, and dead the next.

In observing the females for oviposition, one male was always caged with a female, and in practicallly every case the female outlived not only one, but usually two males successively supplied to her as mates. In nature, the adults are often noted in coitu, and it seems probable that they are promiscuous in mating. Infertile eggs have never been noted, and presumably do not occur under normal conditions, individuals being sufficiently common so that no female should lack long for a mate. The number of adults reared of which the sex was determined was too small to accurately gauge the proportion of sexes, but indicates that the males are somewhat more numerous and possibly may be much more numerous. The apparent preponderance of males can not be due to a smaller amount of food available for the larvae, or, it is posible that, males being normally much more numerous, the intensive feeding of the grubs in captivity resulted in a somewhat abnormal number of females.

"Measurements of 82 males and 63 females taken at Rio Piedras on October 31, 1913, showed the average size of the females to be somewhat greater than the average size of the males. Some males were much larger than some females and some females smaller than some males, but no male was as large as the largest female and no females as small as the smallest male.

"The sexes can be distinguished externally by an examination of the last segment of the ventral surface of the abdomen. In the female the sides of this segment are straight and

converge to a distinct point at the tip, while in the male the sides are somewhat curved, curving in towards the rounded tip of the segment." (8)

Oviposition has not been observed. The original MS of Thos. H. Jones (8) contains the statement that "the eggs are deposited at night," altho this was crossed out by him before it was submitted for publication. So far as the writer's observations go, this statement is, without exception, entirely correct, at least for beetles in captivity. After fresh food and paper was supplied in the morning to pairs under observation, never has a single egg-cluster been found by late in the afternoon, while almost invariably one or two clusters of eggs were present the following morning.

Normally, the eggs are laid in clusters between leaves, or between the split tips of a single cane leaf stuck together with an adhesive. To make two shining tough leaves adhere to each other for seven days, until the eggs hatch, requires an exceptionally effective adhesive, and that used by the female *Diaprepes* appears to be entirely suitable to its purpose. Only one instance has been noted by the writer of its failure to function perfectly. This was in the case of an exceptionally large egg-cluster, laid between mango leaves during rainy weather, in which one leaf had come free, disclosing the eggs. The female rarely chooses tender leaves, on which the beetles might feed, but rather selects old and tough leaves, usually at some distance from the points where the other beetles are congregated. Sometimes two leaves naturally overlap, and in searching for clusters in the field, all such overlapping leaves should be examined. Egg-clusters have been found in the field between the tips of cane leaves and of Guinea grass (8), and between two leaves of jobo, mango, wild fig, caimito, eggplant and grapefruit, but presumably any two leaves, even of a plant not ordinarily used for food, may be used between which to place the eggs. Indeed, Dr. Herbert Osborn Jr., (20) found that the females prefer sheets of paper in captivity, and the writer that they select paper even in the field. In the experiments reported, the area of tough grapefruit leaves suitable for oviposition was several hundred, or thousand, times as great as that of paper exposed, yet two or three times as many clusters were found between the paper flags attached to the stakes to which the

nursery trees were tied, as between the leaves of the trees beneath, when examined at two or three day intervals.

Paper was invariably supplied to all the females in captivity on which observations on oviposition were being made, and the great bulk of the records are from egg-clusters laid between sheets of semi-transparent, oiled paper. Of course this does not simulate conditions in the field, but neither does confinement in a can, and limitation to companionship without a single male, but by providing a stimulus that at least counterbalanced the unfavorable factors of confinement, it certainly resulted in a large, if not the maximum egg-production.

Observations were made on the oviposition of twelve reared females in captivity. Three females, and as many reared males, kept in a can, and supplied with fresh citrus foliage and oiled paper on alternate days, were the first subjects of observation, but in later experiments, each female, with a male, was kept in a separate can. Reared males were used at first to keep with the females, but after three females had been (apparently) murdered by their mates, only males lacking the mandibular appendages, normally lost in burrowing upward thru the soil from the pupal chamber, were used.

Three to seven days elapsed after the females emerged from the ground before they began oviposition. Few general statements can be made regarding the details of oviposition. In some cases, the clusters laid at first, and those towards the end of the period did not contain as many eggs as those laid in the second, third and fourth weeks, while other females laid substantially as large egg-clusters at one time as at another. Some females often skipped a day or two, or more, without laying, while others were very regular in their habits. Some females which laid several large clusters each day, had finished oviposition in two months, or less time; others laid only one or two smaller clusters per day, or less, and continued oviposition for over six months. Most females laid their eggs only between the oiled paper supplied them, a few laid some of their eggs between the paper and leaf, a very few laid some eggs between leaves even when paper was present. A total of 745 egg-clusters was laid by the twelve females, presumably considerably less than the total if the three murdered females had lived to complete oviposition. Of these clusters, two-thirds contained between 30

and 88 eggs, one-eighth containing 30 to 39, and over one-eighth 40 to 49. Over five-eighths of the clusters contained more than 50 eggs, but less than one-eighth contained more than 100 eggs. Eleven clusters containing more than 200 eggs were laid in captivity, the greatest number counted in any cluster being 264.

The data on average weekly egg-laying are not as enlightening as they would be if three females had not been murdered so early in adult life, and if others with a small daily or weekly quota, by living so much longer almost equalled the total number of eggs laid by those laying many more eggs in less than

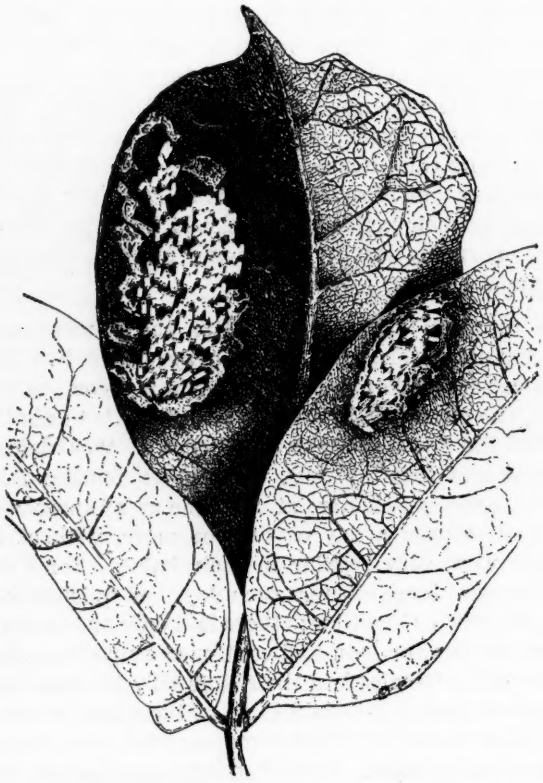


Fig. 2 Egg-clusters of *Diaprepes abbreviatus* L., between leaves of jobo. Twice natural size. (Drawn by F. Seín).

half the time. The twelve females averaged 469 eggs each during the second week of oviposition, and 622 eggs each during the third week. Ten females averaged 528 eggs each during the fourth week, and nine females 572 eggs during the fifth week. After this, the number of eggs laid appears to slump rapidly, but in reality, the fameles still ovipositing at this time are laying almost as many eggs as at any previous time, but those laying most eggs have ceased oviposition entirely. Most females lay fewer eggs in the last week previous to ceasing oviposition, but often lay most eggs, or largest clusters on the last day, or days.

One female laid 7,046 eggs between July 2nd and October 2nd, and six females laid nearly or considerably more than 5,000 eggs each during their periods of oviposition. Two others laid nearly or over 3,000 eggs, and three others were prevented from completing oviposition. (See Table No. 1.)

TABLE 1.

Oviposition by **Diaprepes abbreviatus** L.

Number of Female	U P	First Egg-Cluster	Last Egg-Cluster	Days Oviposition	Total Eggs	Eggs per Day	Date of Death	Cause of Death
44.1	April 28	May 5	June 30	56	5,683	96	July 3	natural
44.7	April 28	May 8	July 9	62	5,683	96	July 14	natural
43.1	May 7	May 14	July 11	58	5,684	96	July 16	natural
40.2	May 11	May 16	June 26	41	2,961	71	June 28	natural
44.3	June 28	July 2	Oct. 2	92	7,046	75	Oct. 10	natural
45.11	Nov. 20	Nov. 23	Dec. 12	19	1,293	68	Dec. 13	murdered
47.5	Dec. 22	Dec. 29	Jan. 19	21	2,109	100	Jan. 21	murdered
47.4	Feb. 8	Feb. 15	Mch. 15	28	1,675	60	Mch.15	murdered
47.00	Feb. 12	Feb. 15	June 7	112	4,982	44	June 7	natural
7.4	Mch. 12	Mch. 18	Oct. 7	203	5,219	26	Oct. 14	natural
7.6	June 7	June 12	Oct. 11	121	5,045	41	Oct. 26	natural
10.2	May 29	June 17	Oct. 25	130	3,335	24	Nov. 3	natural

Altho it is not safe to make statements as to anything being normal or average for *Diaprepes* in most of the details of its life-history, it seems obvious that 5,000 eggs may be considered as a reasonable expectation for most females of the species.

The average of several large egg-clusters indicates that the weight of the individual egg is .00017 gr. Multiplying this by 5,000 gives .85 gr. The minimum weight found for any reared female was .148 gr., the maximum .35 gr. Actually,

these weights mean but little, for when the digestive tract is filled with food and at the same time the ovaries with eggs, the total apparent weight of the female is much more than immediately after emergence from the ground, or at time of death. Even the net weight may vary considerably, as is shown by the weights of one female which on emergence from the ground on June 7th weighed .175 gr., on October 18th, a week after laying her last egg, .246 gr., five days later .222 gr., and .21 gr. on October 26th, on which date she had died. But even after taking into consideration all of these factors, it is obvious that the eggs laid by a female weigh at least twice as much as her own net weight, and may weigh three, four, or even five times as much as she does.

Normally, egg-clusters consist of only a single layer of eggs, altho sometimes towards the center of large clusters two partial layers may be found. Naturally, having the eggs laid in a single layer simplifies their being counted, and by supplying transparent oiled paper to the females, the counts can be made without disturbing the eggs. The shape of the clusters is usually more or less oval, but rarely are all of the eggs laid in a regular manner. The rows of eggs may at times go straight across, but more often each egg following the first is laid beside the other, but by about half of its length further down, making the rows transverse like those of bricks in ordinary construction. Several rows may be laid thus, and then the female apparently shifts to the other side, continuing by laying transverse rows of eggs in the opposite direction, crowding and doubling them sometimes, and rarely making a regular or even cluster. Some clusters are very elongate, often being only two or three eggs wide in the middle, but with more eggs at either end. On the transparent paper, the outline of the margin of the adhesive used can be plainly seen, extending completely around the outside of the cluster. From the way in which the eggs adhere when the enclosing leaves or papers are separated, it appears that all may have been laid on one leaf, to which the other leaf (or paper) is glued, or some may be on one leaf and some on the other. Trying to describe the typical or average egg-cluster is the more difficult because of the infinite variation displayed.

"The eggs are oblong-oval, smooth, glistening, with a rather tough membranous covering, about 1.2 mm. in length

and .4 mm. in diameter. Newly laid eggs are of a uniform milky white, but within a day or two after being laid, clear spaces appear at either end of the egg, this space being more pronounced at one end. Before hatching, the clear spaces disappear and the egg takes on a faint brownish tinge, the mouth-parts of the larva, contained within, being visible through the walls of the egg." (8)

Seven days after oviposition the eggs hatch. This incubation period is the most constant in an otherwise most variable life-history, and is apparently unaffected by any of the ordinary variations in temperature experienced in the tropics. The escape of the grubs from the confines of the egg-cluster's surrounding layer of adhesive may be delayed for some time, at least judging by the numbers of such grubs found and released when one is attempting to collect fresh or parasitized egg-clusters in the field. As previously reported (20), the adhesive is so effective when the cluster is laid between sheets of papr that the grubs do not escape its confines, and eventually perish. The grubs never attempt to pierce the papers or leaves, but eventually find a thin place in the adhesive, or by their wiggling loosen its hold on one of the leaves so that they can escape.

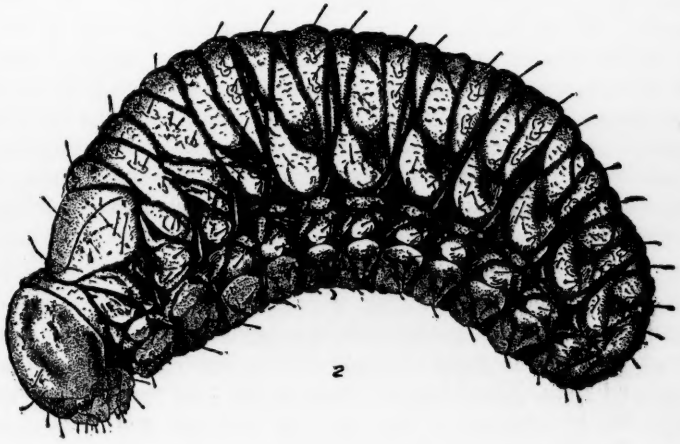


Fig. 3. Larva of *Diaprepes abbreviatus* L., five times natural size. (After Pierce.)

The escaped grubs move across the leaf with a peculiar galloping motion, and when they come to its margin, fall off. They do not burrow into the ground, and if (experimentally) it consists of finely sifted soil moderately well packed and without a crack, they contnue to gallop about for several days, sometimes until their activities have sufficiently disturbed the surface of the soil so that they fall into cracks accidentally, and disappear beneath its surface. Even then, they show no inclination to stay beneath the surface, and a few will ordinarily be moving actively about at or just beneath its surface for a week or more after hatching. In nature, unsifted soil is so full of cracks that they promptly fall into one, and gradually work their way down into the soil so deeply that, barring accidents, they will not again appear at the surface until they become adult beetles. Some of the grubs happen to come in contact with minute rootlets, and eat and grow big enough to molt to second instar within a few days; others may wander about for a week or longer, apparently without eating, and some are still in the first instar while others of the same egg-cluster have grown to third instar size. Presumably some or most of these grubs which fail to come in contact with suitable food, or fail to learn to eat it within the first few days after hatching, also fail entirely and irrevocably, but others, even as long as two weeks after hatching, finally do eat and grow, and altho retarded at the beginning in their rapidity of growth, pupate at almost exactly the same time as do the most rapidly growing of their brothers and sisters, and develop into adults quite as vigorous. Apparently the margin of survival here is very broad, extensive enough to allow for several days at least after hatching before the grubs escape from the egg-cluster, and, if not needed there, equally useful before the grub must find food in the ground.

Presumably the grubs feed on any kind of living root of suitable size with which they come in contact in the ground. Definite records are available of their being collected in the field attacking only the roots of sugar-cane, grapefruit, pepper, lima bean and yuca. Lima beans were used as food for some of the grubs in the laboratory, but the bulk of them were reared on corn. The attack of the larger grubs on the root-stalks of sugar-cane, into which they burrow, has long been known, and has been considered the principal injury to economic crops caused

by this pest. The small grubs do not hesitate feeding on roots too small for them to burrow inside of, and indeed the habit of

Fig. 4. Larva of *Diaprepes abbreviatus* L., feeding in root-stalk of sugar-cane. One-half natural size. (Drawn by F. Seín).

burrowing inside of their food supply seems not to be well developed until they are partly grown. The smallest grubs have not been noted burrowing into kernels of corn, but only feeding on corn rootlets from the outside, but third and forth instar grubs often burrow inside dry and unsprouted kernels of corn, growing much more rapidly than others on the outside feeding on the roots or rootlets.

The grubs of *Diaprepes* are apparently so well able to withstand long periods of fasting at any time in their growth that only the outmost care in continually providing fresh and attractive food in abundance is the experimenter able to induce them to feed to capacity and make most rapid gains in weight until full size is attained. By comparison with the industrious manner in which caterpillars feed, the grubs of *Diaprepes* are

most dilatory, and only when they are completely surrounded by food do they display their maximum capacity for rapid growth. As shown by the number of days for them to reach sixth instar, the rapidity of their growth is as follows: for those hatched in March 79 days, for those hatched in May 80 days, in June 55 days, in July 55 days, in August 57 days, in September 42 days, in October 54 days, in November 51 days, in December 46 days and in January 50 days. If dependence may be placed on these data, obtained from eighteen eggs clusters in ten months, slowest growth from grubs hatching in the spring is indicated, and most rapid growth of grubs hatching early in the fall. The extremes are represented by one grub hatching in September which attained sixth instar in 27 days from hatching, and another hatching in March which required 126 days to attain the same size, extremes, however, which are typical of all grubs hatching in the autum versus those hatching in the spring.

By comparison with the variations in some other periods of the insect's development, that in growth seems insignificant, but if it means anything at all, it may be part of the tendency of the individuals concerned to return to a year life-cycle, with the eggs normally laid in the summer. So far as can be determined, it is not a reaction to temperature, as the seasonal variation of the temperature means averaged only 10°F. at Rio Piedras (12°F. between minimums, 8°F. between maximums, recorded in the Insectary beside the rearing cans and tubes), or only half the difference between the average day and night extremes of the twenty-two months of which the records were kept. Thus, while grubs grew most rapidly in September, and most slowly in March and May, those from eggs hatching in June, July and August paralleled in rapidity of growth those hatching in October, November, December and January. It should be especially noted, also, that the seasonal variation in rapidity of growth is by no means as great as the individual variation shown by grubs from the same egg-cluster.

As previously noted (21), the minimum time in which a grub has been reared to full size (eighth instar) is 48 days, and another grub from the same egg-cluster, 53 days, but two other grubs from the same egg-cluster, which required over twice as long to attain the same size, pupated and shortly afterward transformed to adult at practically the same time. Molting to

Variation in Rapidity of Growth of Larvae of **Diaprepes abbreviatus** L., as shown by 140 individual records in 2nd Instar (left), 170 individual records in 4th Instar, 193 individual records in 6th Instar and 130 individual records (for growth period only) in 8th Instar (right).

Each horizontal series of squares in an instar group represents one individual record (those in the same line in different instar groups are rarely and only accidentally of the same individual); the number of squares indicates days, the distance between the two vertical lines represents 100 days, the one on the left being date of hatching of the larva from the egg.

eighth instar has been taken to mark the time of maximum weight, but unfortunately for consistency in making the records, many grubs do not molt that many times as larvae, but pupate from the sixth instar. Thus, to make all data comparable, the records have been grouped on the basis of the rapidity with which the grubs reached sixth instar. They indicate tremendous variation in rapidity of growth in the various larval instars, a variation which is even more obvious in the accompanying graph. (See graph.)

The grubs of *Diaprepes* may have as few as six larval molts before pupation, but normally have eight, and may have many more. Before the experimenter realized the necessity of the grubs for a diapause period during or after growth, and while he was continuing to supply them with an abundance of food, which they half-heartedly attempted to consume, some of them molted as many as a sixteen times, one successfully pupated after molting fifteen times, another after thirteen molts, one after twelve, two after eleven, and many after molting ten or nine times as larvae. Ordinarily, larval molts exceeding the usual number are a reaction to unfavorable conditions such as cold, or lack of food, but in the case of *Diaprepes*, the unfavorable condition appears to have been a surplus of food.

A diapause period in the life-history of *Diaprepes* is not only normal, but apparently essential before the fully-grown grub can pupate. At the beginning of this period, the grub is very active, and presumably in nature may travel to considerable distances in the ground. It eats, more or less, but continually less, and becomes less active as the period of pause lengthens. Normally, it does not molt, and the period from the last larval molt until pupation may be considered the extent of this period of waiting.

The diapause period may be for less than two months, or it may be for nearly thirteen months. Its extent is not appreciably affected by previous rapidity of growth, the time of the last larval molt, humidity of the soil, temperature or time of year. So far as the writer can determine from the data available, it is entirely unpredictable. For instance: of two grubs hatched in September, one, molting to ninth instar after 144 days, waited 315 days before pupating, the other, molting to eleventh instar after 115 days, pupated in 55 days. These grubs

TABLE No. 2

Duration in Days of Diapause Periods of Larvae of *Diaprepes abbreviatus* L. grouped according to the Month in which the Larva Hatched.

November	December	January	March	July	September
					55
					65
					68
					75
					76
					89
					90
			91		90
					94
					95
			106		102
				123	
				124	
			129	124	
				131	
				132	
				133	
			134	133	
	137			138	
			140	142	
				145	
		153		152	155
				157	156
					169
	171	172	172		
			175		
	187	185			
			197		193
			199		
202	200		200		
	223	223	220		226
					231
246		241	244		
		236			233
		250			
		250			250
255			261		
265		266	264		263
		277	271		
283		282			
			291		
		297			
		299			
		299			
318					315
		341	347		
			388		

were side by side in identical glass tubes, receiving the same amount of moisture from the moistened sand below. The diapause periods of others from the same egg-clusters, which had grown very rapidly were: 65, 68, 76, 89, 90, 102, 155, 156, 169, 226, 233 and 267 days after the last larval molt. Other grubs from the same lots, which grew more slowly had diapause periods of 91, 106, 129, 134, 135, 140, 172, 175, 197, 199, 200, 244, 261, 264, 271, 291, 347 and 388 days. There appears to be no consistency here. Out of twenty-six grubs hatching in November, December and January, twenty-two had diapause periods of eight months and longer, the two longest being 318 and 341 days. The only group of grubs showing any consistency are those hatching in July, all twelve of which had diapause periods of four to five months. That is, of this group only, one might with reasonable confidence predict the extent of the diapause period. (See Table No. 2)

If one is to suppose that the grubs hatching in July (or a little earlier or a little later) from eggs laid in June, represent the normal, original life-cycle, that they should all attain full size at about the same time and all be ready to pupate at about the same time seems only reasonable. As has been previously pointed out however (21), the egg parasite, *Tetrastichus haitiensis* Gahan, is most abundant in June, consequently few grubs survive from eggs laid at this time. Survival, for *Diaprepes abbreviatus* wherever this parasite is present, depends largely on being different, on deviating from the normal, and thus bringing the period of oviposition at a time of year when the egg parasite is scarce. The period of incubation of the eggs is very definitely fixed at seven days, that of growth varies only from two to four months, and that of the pupa from fourteen to twenty-six days, and that of the aerial adult female is but little more than the time necessary to lay her eggs. The two perods least defintely fixed, or susceptible to the greatest variation, are as adult in the soil or as a larva in the diapause period. The maximum recorded diapause period, 388 days, is seven times that of the minimum, 55 days.

Early in the diapause period the grub wanders about in the soil with tremenduous energy, in captivity churning up the small amount of soil available in its restricted quarters and breaking off the roots of any plant growing within the container.

Fig. 5. *Tetrastichus haitiensis* Gahan, sixty times natural size. (Drawn by G. N. Wolcott.)

In nature, its wanderings are directed towards no fixed goal, and it may eventually come to rest close to where it started, yet many grubs, by accident, doubtless wander far afield. The survival value of this display of energy is not obvious, and seems to lead nowhere. It may be an attempt to escape from externally parasitic mites. These mites, determined by Dr. H. E. Ewing, of the U. S. National Museum, as *Rhizoglyphus phylloxerae* Riley, first appear on the head and body of the grub when it is about half grown, continuing to be present in increasing numbers on some individuals until pupation. At each molt the grub escapes from the mites if it moves away soon afterwards from the molted skin to which the mites still remain attached, but this easy escape from their tormenters is no longer available during the diapause period, when it does not normally molt. The mites can be dislodged artificially by rubbing, and possibly some of them are rubbed off by the grub in rapidly making its way thru the soil. The grub appears to show no deleterious ef-

fect from a light infestation of mites, but when they completely cover the head and fore part of the body, one may be reasonably sure that that particular grub will not survive to become adult. Of course such heavy infestations are presumably due to the artificial conditions and close quarters under which the grubs are reared, and would occur but rarely, if at all, in nature.

The wandering of the grub during the diapause period may also tend to lessen the mortality caused by the Green Muscardine fungus, *Metarrhizium anisopliae* Sorokin, by shifting the position of the grub in the soil to localities where the humidity is less favorable to infection by and growth of the fungus. Numerous grubs, many pupae and a few adult beetles (while still in the soil) died as a result of infection by the Green Muscardine. In most cases, the insect was accidentally injured, mite-infested, or sub-normal before infection by the fungus took place, and no instance can be recalled of any insect supposed to be entirely normal and healthy sucumbing to infection by the Green Muscardine. Indeed, many mite-infested and subnormal individuals seemed to have surprising high resistance to fungus infection, and often lived for days, weeks, or even months before finally succumbing to attack. Thus, the conclusion of the experimenter is that this fungus is not strongly pathogenic, but merely is the first to develop in insects about to die primarily from some other cause. The many deaths of grubs recorded as being due to this fungus or to mass infestations of mites are in reality due to the somewhat abnormal conditions under which the grubs were reared, and dropped considerably towards the end of the investigation when rearing methods had been more nearly perfected. Under normal conditions in the field, it is believed that neither the mites nor the Green Muscardine are of importance in causing larval mortality of *Diaprepes*.

Indeed, the extraordinary energy displayed by the grub in wandering about at the beginning of the diapause period seems almost inexplicable, as it does not terminate in the selection of a different and more desirable location for the pupal chamber, as at the very end, the more or less quiescent grub again changes its position. Thruout the diapause period the grub rests or travels horizontally or transversely in the soil. When ready to pupate, however, it forms a vertical chamber in the soil, and rests in it with the head up. It is a very active, and

spins round and round on its caudal end in the pupal chamber, compacting the soil of the walls. Pupation occurs within two or three weeks after the chamber is formed.

Pupae are formed in every month of the year, but of the records available, nearly one-third are in the month of March. Almost a sixth are in the month of October, with no definite trends for the other months. Obviously, March is the normal, original month, the others quite as obviously being wide variations from this norm. Fifty records are available as to the duration of the pupal period, but due to the difficulties of observation in many cases, too much exactitude can not be claimed for all of them. Nine days is the recorded minimum (which seems doubtful), but almost a third are of 14, 15 and 16 days, and slightly more than two weeks seems normal. The bulk of the records are from 17 to 26 days, the few of greater length being of doubtful verity.

When first formed the pupa is entirely waxy white, but a few days before the adult is to emerge, the eyes of the pupa begin to darken, the claws are seen to be black, and the underwings are clouded with grey. The color deepens rapidly, and within a few days the adult will have crawled out of the pupal skin. Within a day it is fully colored, at least in the chambers which were open on one side for observation. Whether the color transformation is as rapid as this in complete darkness was not determined. The adult remains quietly in its pupal chamber long after it is apparently hard and physically able to emerge. To determine what factors might be responsible for the emergence of the adults from the ground, complete daily records of maximum and minimum air temperatures were kept, and some tubes watered profusely from the top, while others received only the moisture coming up from the wet sand below. While one or two adults might appear to have been affected by sudden temperature changes, or hurricane weather, or excessive moisture, so many others were unaffected that the only conclusion reached from the experimental evidence was that the adults emerged entirely without reference to external factors.

Eleven days is the minimum recorded time for the adult vaquita to remain in the pupal chamber before coming to the surface of the ground and 126 days the maximum, or twelve times as long. The length of the period appears to be entirely fortuitous: of the forty-six records, somewhat over a third are

between 33 and 48 days, and nearly half are for over two months. The records of individuals which hatched from eggs in July show not quite as much variation as do all the others, the extremes being 20 and 92 days, and over half being between 33 and 48 days. Possibly in nature, continued heavy spring rains would be more effective in bringing most of them to the surface at one time than the temporary drenchings experimentally attempted in the tubes, indicating that five or six weeks may be normal extent of this period. The suddenness with which numerous adults appear in Barbados after the spring rains have commenced, following a comparatively dry winter, has suggested the probability that the rains are the stimulus causing pupation (13). It seems much more likely that the rains are the stimulus for the emergence of the adults, as pupation presumably took place several months previously. Since no egg parasite of *Diaprepes* occurs in Barbados, the insect is not faced with the necessity of varying from its normal life-history if it is to survive, and consequently most of the adults appear at one time in the spring.

During most of the period when the adult is in its pupal cell, it appears ready to emerge at any time, being completely hardened, and, if disturbed by having its cell broken into, will crawl out immediately and act as tho it had emerged normally. If replaced in its cell, and the top layer pressed into place, it may remain there for the time being, but in every case was at the surface of soil by the next morning. In the summaries of life-histories, no distinction is made as to whether the time of emergence was normal or artificially induced, and is indicated as "up".

The Otiorhynchid, or "scarred-snout" beetles, to which group *Diaprepes* and allied species belong, are characterized by scars at the end of the beak marking the disappearance of the so-called "mandibular appendages," which, in the case of *Diaprepes*, are prominent, curved, black claws, even larger than the jaws with which the insect eats. The presumed purpose of these mandibular appendages is to enable the insect to make in June of the second year following, and two others (which buried pupal chamber, and they are supposedly just strong enough for this, yet so insecurely attached to the beak that they will fall off soon afterwards (being no longer needed by

the insect), leaving scars on the beak where they were attached. The pupal chamber of *Diaprepes* normally occurs at a considerable depth in the ground, at a much greater depth than could be obtained in the glass tubes used in the rearing experiments. Consequently, in digging their way out thru the comparatively small amount of earth over their pupal chambers, several of the beetles failed to dislodge these mandibular appendages, one or both of which remained attached as long as the individuals lived. They appeared to be very much in the way of the insect when feeding, the punctures made by the appendages being very noticeable beside the margins of the leaves where these beetles had been eating. Most of the individuals failing to loose these claws were males, the results of this abnormality in three cases resulting in the untimely death of their mates. One can not be sure that the presence of these claws on the jaws of the male was responsible for the death of the female, yet no more females died when supplied only with males lacking these formidable appendages, and the evidence seems reasonably conclusive. In nature, such occurrences would be rare, if they occurred at all, and in the present instance were due to the interference of man.

The total life-cycle of *Diaprepes* may be considerably less than one year, or it may be over two years. It must be admitted that no individual records of the latter maximum have been obtained, but that they actually occur seems quite certain. The minimum period is of larvae which hatched from the egg in September, and of which adults emerged from the ground by the following April. Within less than a week after the female adult has emerged from the ground she begins to lay eggs, and by a week later these eggs have hatched. This is not an exceptional or unusually short life-cycle for the insect, as all of the reared individuals hatching in July, and the bulk of those hatching in September completed their development in a month less than a year.

By contrast, all of the grubs hatching during the winter months required at least a year for their development, most of them several months longer, and of those hatching in January, records are available of one female emerging from the ground in June of the second year following, and two others (which escaped without their sex being determined) in July of the second year. Altho some females have finished laying all of

their eggs within two months, others require more than twice as long, and one is recorded as requiring nearly seven months after emergence from the ground before she had laid her last egg. From egg to egg in this (theoretical) instance over two years elapse.

Presumably the normal, original life-cycle approximated one year, with the adults appearing above ground in the late spring and early summer. Most of the females appearing at this time of year lay all of their 5,000 or more eggs in less than two months, thus, altho some scattering might occur, most of the individuals would maintain the one year life-cycle. Judging by the records available, the grubs from the earliest egg-clusters (May) would be slowest in developing to adults (May to August), and those from the latest (September) most rapid (April and May).

Opposed to this tendency of some individuals to return to the normal one year life-cycle, is that of others, farthest removed from the normal time of egg-laying, to develop a much longer cycle shown in the records by one September-hatched grub emerging as adult in the second November following, November and December-hatched grubs emerging in the second April following, and January and March-hatched grubs with emergences of adults scattered from the following December to June and July of the second year. (See Table No. 3.)

The total number of rearing records on which this paper is based is close to two hundred forty, and even of the life-cycles completed to the natural death of the adult is so large as to preclude publication in full. Yet it seems desirable to present some presumably typical case histories. In all of these, the number of days given is from date of hatching of the egg. The numbering of the individual is a decimal, that of the egg-cluster from which it hatched is the whole number preceeding the decimal point. Ordinarily, the most rapidly growing grubs were separated from the others from an egg-cluster when in third instar, and given a number at this time; thus .1, .2, .3, .4, etc. are presumably the most vigorous grubs, while .11, .12, .13, etc. are less rapidly growing grubs, separated from the others at a later date, and .00, and .0 are the runts, those left in the original can after all the other larger ones had been removed and placed in separate cans.

TABLE No. 3.

Month of Emergence from Pupal Cell of Adult of *Diaprepes abbreviatus* L., arranged according to the Month in which the Larva Hatched.

Month Larva Hatched	Adult emerged from Pupal Cell in month of:												
	Nov	Dec	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
November	?	♀	♂	♀♀		??							
December		♀				♂							
January		♂	♂ ?		♀	♂ ♀	?	♀	??				
March		?	♂		♂♂ ♀		♂ ?	♀					
May					?		♀ ?			♂			
July						???	♂♂ ♀♀♀ ?	??					
September						♂♂♂ ♀ ??	???	♀ ???	♂♂♂ ??	♂	♂		♀

Diaprepes abbreviatus L. individual No. 44.1 hatched from the egg September 7, 1933, molting to successive larval instars up to and including the tenth in 7, 11, 15, 20, 27, 34, 48, 95 and 117 days, having a diapause period of 76 days before pupating on the 193d day (March 19th, 1934), transforming to a female adult on March 28th, and coming to the surface of the ground on April 30th. She was one of three females whose combined egg production was 17,050 eggs, and she died on July 3, 1934, 299 days after hatching of the larva from the egg.

Inividual No. 44.3 molted to the tenth larval instar on the 119th day, and was noted as a soft adult on March 27th, but did not come to the surface of the ground until June 26th. She laid 7,046 eggs, and was very tenacious of life, appearing dead on October 3rd, but was not actually devoid of life until Oct.

10, 1934, at which time she weighed .345 gr. From date of hatching, she had lived 398 days.

Individual No. 44.8 molted to the tenth larval instar on the 105th day, but had a diapause period of 263 days before pupation. The male adult was first noted on September 25th, over a year after the date of the hatching of the larva, came to the surface of the ground on October 23d, and was dead by November 26th, weighing .144 gr. at time of death.

Individual No. 44.24 molted to the ninth larval instar on the 100th day, and pupated 94 days later. The adult male emerged from the pupal cell on July 18th, having been there as a fully-formed adult since April 4th. He died on August 11th, 27 days less than a year after the grub had hatched.

Individual No. 45.3 hatched from the egg on September 11, 1933, molting to successive larval instars up to and including the eleventh in 10, 22, 26, 30, 36, 49, 60, 81, 94 and 115 days respectively, and with a diapause period of only 55 days, transformed to pupa on March 1st. Becoming adult on the 19th, a male came to the surface of the ground on April 28th, and was dead June 7th, or 96 days less than a year after the grub had hatched.

Individual No. 47.5 hatched from the egg on November 24, 1933, molting to successive larval instars up to and including the ninth in 10, 17, 25, 36, 41, 56, 68 and 89 days, had a diapause period of 246 days, not becoming a pupa until October 25th of the next year. Development thereafter was rapid, however, a female adult weighing .32 gr. emerging from the pupal cell on December 22nd. She laid 2,109 eggs before being found dead on January 21, 1935, presumably having been murdered by 8.00, a male which still had his mandibular appendages. At death she weighed .313 gr.

Individual No. 47.4 had an even longer diapause period of 265 days, after having molted to eighth on the 89th day. A soft adult was noted in the pupal cell on December 2nd, but the female did not emerge until February 8, 1935. She began laying eggs on the 15th, and had laid 1,675 before March 15th, on which day she was found dead. The male with her, No. 5.6, had no

mandibular appendages. When she emerged from the ground she weighed .331 gr., and at time of death .35 gr.

Individual No. 47.00 was the slowest to grow of all the grubs hatching from the egg-cluster, but entering the diapause period from the seventh instar on the 74th day, was not observed making a cell until November 13th. The adult was first noted on December 8th, a female which came to the surface on February 12th, and laid 4,982 eggs before she was found dead on June 12th. At emergence from the ground she weighed .163 gr., and at death .157 gr.

Individual No. 5.5 hatched from the egg on January 5, 1934, molting to successive larval instars up to and including the eighth in 9, 18, 28, 38, 45, 66, and 94 days, and did not transform to a pupa until over a year from the time of hatching. An adult male weighing .17 gr. came out of his pupal cell on April 12th, and lived until July 1, 1935. At time of death he weighed only .055 gr.

Individual No. 5.2 almost exactly paralleled her brother, emerging from her pupal cell on April 9th, weighing .34 gr., and was released.

Individual No. 6.2 hatched from the egg on January 14, 1934, molting to successive larval instars up to and including the seventh in 11, 15, 27, 33, 52 and 80 days, pupating on November 27th, and transforming to adult on December 18th. The adult male came out of his pupal cell on January 21st, weighing .266 gr., and lived until June 26th, weighing .252 gr. at time of death. This male outlived the female 47.00, with which he was confined, and possibly may have murdered her, altho possessing no mandibular appendages at the time of emergence from the soil. A total of 537 days elapsed from date of hatching of the egg till the death of the male beetle.

Individual No. 6.7 molted to 6th in 56 days, but waited until the 113th day before molting again, and pupated 282 days later. The adult was noted on March 11th, but did not come to the surface until June 10th, a female weighing .286 gr., who was released.

Individual No. 7.1 hatched from the egg on March 1, 1934, molting to successive larval instars up to and including the

eighth in 14, 20, 30, 39, 63, 72 and 126 days respectively. After 264 days of waiting, it pupated on March 26th, 1935, the adult being noted on April 15th, and emerging as a male on May 11th, weighing .157 gr. He died on July 22nd, weighing only .095 gr. at time of death.

Individual No. 7.5 molted to the seventh larval instar in 135 days, but was observed in a cell by December 24th, and had become a pupa by January 4th. The male adult appeared March 29th, weighing .15 gr., and living until August 19th, at which time he weighed .16 gr.

Individual No. 7.4 molted to 9th on the 136th day, had become a pupa by October 24th and transformed to adult by November 11th. The female adult did not appear above ground, however, until March 12th of the following year. She lived until October 14th, and laid 5,219 eggs, at time of death weighing .193 gr.

Individual No. 7.6 molted to 7th on the 91st day, waiting until exactly one year after date of hatching before transforming to pupa. She appeared above the surface of the ground as a female beetle on June 7th, weighing .175 gr., was confined with her brother, 7.5, and laid 5,045 eggs before her death on October 26th. On the 18th, she weighed .246 gr., on the 23d, .222 gr., and when dead, .21 gr.

Individual No. 9.1 hatched from the egg on May 11, 1934, molted to successive larval instars up to and including the sixth in 20, 35, 50, 69, and 87 days respectively, but waited over a year after date of hatching from the egg before being observed to be forming a pupal cell. An adult male, weighing .153 gr. appeared above ground on June 19th, and died towards the end of October.

Individual No. 10.2 hatched from the egg on May 15, 1934, molted to successive larval instars up to and including the seventh in 36, 47, 65, 72, 83 and 122 days respectively, transformed to a pupa by January 21st and an adult by February 14th. A female adult weighing .127 gr. appeared on May 29th, began oviposition on June 17th, and by October 25 had laid 3,335 eggs, being confined with the male 9.1. On October 28th she weighed .222 gr., and on November 3d, .133 gr., apparently having died a day or two earlier.

Individual 935.1 hatched on June 7, 1934, from an egg-cluster collected at La Indiera in the mountains north of Yauco, and molted to successive larval instars up to and including the seventh in 14, 20, 28, 32, 47 and 98 days respectively. On September 13th, it weighed .408 gr., and on February 21, 1936, .269 gr., indicating a considerable loss of weight during the diapause period, altho this may in considerable part have been due to lack of attention for the preceeding month.

Individual No. 935.14 had just molted to the sixth larval instar on the 57th day after hatching, at which time the grub weighed .288 gr. When examined on February 22nd, it had become a male adult weighing .197 gr., which was released.

Individual No. 43.1 hatched from the egg on July 21, 1933, molting to successive larval instars up to and including the eighth in 22, 28, 34, 48, 52, 71 and 91 days respectively, and after a diapause period of something less than five months, was noted as a soft adult in the pupal cell on March 26th. Appearing above ground on May 7th, this was one of the females which, with 44.7 and 43.0, laid a total of 17,050 eggs. She died on July 16th.

Individual No. 43.0 grew just as rapidly up to the 5th instar, but after that the molts were on the 56th, 67th, 80th and 101st days. The pupa was observed on March 17th, and the soft adult on the 26th, the female appearing above the surface on May 7th. She was confined with 44.7 and her sister 43.0, and three males, being found dead on July 16th.

Individual No. 42.0 hatched from the egg on July 26, 1933, molted to successive larval instars up to and including the sixth in 12, 17, 35, 45, 52 and 92 days respectively, and was first noted as a pupa on March 20th. Transformed to a soft adult by April 4th, the male appeared above ground on May 11th, and had died by June 20th, or almost exactly a month less than a year after the egg was laid.

Individual No. 40.2 hatched from the egg on July 28th, 1933, molted to successive larval instars up to and including the tenth in 14, 21, 30, 39, 45, 54, 73, 81 and 102 days respectively, and was first noted again as a soft adult on March 26th of the following year. The female emerged on May 11th from the ground, and being confined with the male 42.0, who had

emerged on the same date, outlived him by only a week, laying 2,916 eggs before her presumably premature death.

Thus reduced to the essential outline, there appears to be such a similitarity about these case histories that the fundamental differences escape observation. It is only when the details of all of them are compared that the differences become obvious, as is indicated, it is hoped, in the first part of this paper. Looked at in another way, there is something touchingly human about these bare records, like those carved on the tombstones of a cemetery, only the wealth of incident due to a more complicated insect life-cycle necessarily gives them fuller detail between the two termini of birth and death.

SUMMARY

1. The females of *Diaprepes abbreviatus* L. lay 5,000 or more (or less) eggs in as few as two months, May and June, or in as many as seven months at other times of the year, often living over twice as long as do the males after emergence from the soil.

2. The incubation period of all eggs is seven days. Larvae attain full size in two to four months. A diapause period is absolutely essential before pupation. The pupal period is about two weeks. Fully-formed adults remain within the pupal chamber for a variable period of weeks or months, the length of this period and that of the diapause period of the larva being subject to great variation.

3. The great variation in the duration of the diapause period of the larva and before the emergence of the adult from the pupal cell in the ground permits some individuals to complete their life-cycle (hatching of eggs to first egg-cluster laid by female, or to emergence of male from soil) in less than eight months, but for other individuals it may extend for eighteen months (hatching of egg to last egg-cluster laid by female, or to death of male).

4. Deviation from a one-year life-cycle is of tremendous value to *Diaprepes abbreviatus* L. in enabling its eggs to escape attack by a common parasitic wasp, *Tetrastichus haitiensis* Gahan, which is most abundant during the late spring, but very scarce during autumn and winter.

BIBLIOGRAPHY

1. **Ballou, H. A.,** "Insect Pests of the Lesser Antilles" Pamphlet Series No. 71, Imperial Dept. Agr. W. I., pp. 210, fig. 185. Barbados, 1912. (see pp. 66-69, figs. 70-73.)

2. **Bruner, S. C.,** "Observaciones sobre le Picudo Verde-Azul de los Naranjos." Rev. Agr. Comercio y Trabajo, 14, (19): 35-40, fig. 2, tab. 1. 1934. (tests of control measures).

3. **Cook, M. T. & Horne, W. T.,** "Insects and Diseases of the Orange." Bul. No. 9, Estación Central Agronómica de Cuba, pp. 44, pl. 19. 1908. (see pp. 11-17, pl. 5-6).

4. **Cotton, R. T.,** "The Larva of the Weevil *Exopthalmus quadrivittatus* (Olivier)." Proc. Wash. Ent. Soc. 31, (2); 27-31, pl. 1. Washington, D. C., February 1929. (a detailed description and comparison with that of *Diaprepes abbreviatus*).

5. **Dozier, H. L.,** "Descriptions of New Trichogrammatid (Hymenoptera) Egg Parasites from the West Indies." Proc. Wash. Ent. Soc., 34, (3); 29-37. 1932. (original description of *Ufens osborni*).

6. **Gahan, A. B.,** "Description of an Egg-Parasite of *Exopthalmus quadrivittatus* (Olivier)." Proc. Wash. Ent. Soc., 31, (1); pp. 17-18. 1929. (original description of *Tetrastichus haitiensis*).

7. **Hutson, J. C.,** "Some Weevils of the Genus *Diaprepes* in the West Indies." Agr. News, 16, (395): 186. Bridgetown, Barbados, June 16, 1917, and (399): 251, Aug. 11 1917.

8. **Jones, T. H.,** "The Sugar Cane Weevil Root Borer (*Diaprepes spengleri* Linn.)." Bull. 14, Insular Experiment Station, Rio Piedras, P. R., pp. 19, fig. 11. 1915.

9. **Marshall, G. A. K.,** "On New Neotropical Curculionidae." Annals & Magazine of Natural History, (Ser. 8), 18: 449-469. London, December 1916. (includes on p. 451 a discussion of the nomenclature used by Pierce (14).

10. **Marshall, G. A. K.,** "On New Genera and Species of Neotropical Curculionidae." Trans. Ent. Soc. London, Parts I & II. pp. 181-224, pl. 2. London, July 31, 1922. (contains, on p. 189, a discussion of the genus *Exophthalmodes* Pierce.)

11. **Myers, J. G.,** "A Preliminary Report on an Investigation into the Biological Control of West Indian Insect Pests." Empire Marketing Board, 42, pp. 173, pl. 2, many ref. London, July 1931.

12. **Nowell, Wm.,** "Field Investigation of Beetle Grubs Attacking Roots of Sugar-Cane." Rpt. Local Dept. Agr. Barbados 1911-12, pp. 50-51. 1912.

13. **Nowell, Wm.,** "Report of the Assistant Superintendent of Agriculture on the Entomological and Mycological Work carried out during the Season under Review." Rpt. Local Dept. Agr. Barbados, 1912-13, pp. 34-45.

14. **Pierce, W. D.,** "Some Sugar-Cane Root-Boring Weevils of the West Indies." Jour. Agr. Research, 4, (3): 255-267, pl. 4. Washington, D. C., June 15, 1915. (excellent illustrations.)

15. **Watson, N. B.,** "The Root-Borer of Sugar-Cane (*Diaprepes abbreviatus*)." West Indian Bulletin, 4, (1): pp. 37-47 fig. 3. 1903.

16. **Wolcott, G. N.,** "Vaquitas de Importánica Económica en Puerto Rico." Circ. No. 60, Est. Expt. Insular, Río Piedras, P. R., pp. 20, fig. 20. 1922.

17. **Wolcott, G. N.,** "Notes on the Life-History of *Exopthalmus quadrivittatus* Olivier (Coleoptera)." Proc. Washington Ent. Soc., 31, (2): 21-26. Washington, D. C., February 1929.

18. **Wolcott, G. N.,** "An Economic Entomology of the West Indies." pp. xviii & 688, fig. 111. Ent. Soc. of P. R., San Juan, September 1933. (see pp. 134-142 & 450-461.)

19. **Wolcott, G. N.,** "The Larval Period of *Diaprepes abbreviatus* L." Jour. Dept. Agr. P. R., 17, (3): 257-264, pl. 1, tab. 1, ref. 2. 1933.

20. **Wolcott, G. N.,** "Otiorhynchids Oviposit between Paper." Jour. Ec. Ent., 26, (6): 1172-1173. 1933.

21. **Wolcott, G. N.,** "The Diapause Portion of the Larval Period of *Diaprepes abbreviatus* L." Jour. Agr. Univ. P. R., 18, (3): 417-428, fig. 1, pl. 1, ref. 1. 1934.

THE CICADELLIDAE OF CUBA

By Z. P. METCALF

College of Agriculture, University of North Carolina, Raleigh, N. C.

and S. C. BRUNER

Estación Experimental Agronómica, Santiago de las Vegas, Cuba.

The present paper is one of a series of papers on the homopterous fauna of Cuba (Metcalf and Bruner 1925a, 1925b, 1930a). The homopterous fauna of Cuba has been sadly neglected but we hope to publish systematic reviews of all the families. At the time this paper was prepared the literature recorded 5 species of Cicadellidae from Cuba. The present paper records no less than 32 species and varieties.

HISTORY

The earlier writers, notedly Walker (1851b) and Signoret (1853a, b, c; 1854a, b, c, d; 1855a, b, c, d), contributed greatly to our knowledge of this family especially in relation to the Cuban fauna. Guerin-Meneville (1856a, 1857a) mentions but a single species. Osborn (1926a) mentions the economic relations of three Cuban species.

Melichar (1924a, 1925a, 1926a, 1932a) started a monograph of the genera and species of this family but unfortunately this has not been completed and many new genera he proposed in his keys have not been established. Osborn (1926b) reviewed the Neotropical species and described many new species from South America and he also (Osborn 1935a) reviewed the species from Porto Rico and the Virgin Islands, several species being common to Cuba.

CLASSIFICATION

This group has been variously classified as a tribe, subfamily and family. Baker (1923a) was the first, to clearly establish this group as a family and in our opinion it is entitled to this rank. It may be distinguished from the other jassids by

the following characters: Body not greatly flattened; ocelli on the crown; lateral clypeal sutures continued onto the crown.

The following key will aid in the differentiation of the generic and subgeneric groups.

KEY TO THE GENERA OF CUBAN *CICADELLIDAE*

A. Anterior tibiae sulcate or dilate apically; tegminae narrow not covering lateral margins of abdomen. Antenial ledges prominent. Subfamily *Proconiinae* (No members of this subfamily have been found in Cuba).

AA. Anterior tibiae slender, terete or prismatic; antennal ledges not prominent; tegminae broad-- Subfamily *Cicadellinae*

B. Tegminae reticulate apically----------Tribe *Draeculacephalini*

C. Crown flat with a definite edge; face in profile nearly straight. -------*Draeculacephala* Ball

CC. Crown and face conically produced margins rounding; face in profile infla ted---------- *Carneocephala* Ball

BB. Tegminae not reticulate apically---------Tribe *Cicadellini*

C. Radius branching forming a distinct first radial cell ---------- 1

1. Three large anteapical cells---------- 2
1. With one or two subapical cells---------- 4
2. Head broader than pronotum, obtuse anteriorally; eyes prominent ---------- 3
2. Head not as broad as pronotum, conically produced anteriorally; eyes not prominent-- *Hortensia* Metcalf and Bruner
3. Anterior margin of crown continuing the outer margin of the eyes; pronotum about two-thirds as long as broad, the anterior lateral angles rounded continuing the curve of the anterior margin--*Poeciloscarta* Stal.
3. Anterior margin of crown not continuing the outer margin of the eyes; pronotum nearly twice as broad as long, anterior lateral angles distinct----*Cicadella* Dumeril
4. With two large subapical cells, first radial and medial *Ciminius* Metcalf and Bruner
4. No anteapical cell save first radial--------- 5
5. Crown elongate brondly rounded on anterior margin--------*Entogonia* Melinchar
5. Crown much broader than long------*Kolla* Distant

CC. Radius unbranched before apical cells; anteapical cells small or very small---------- 1
1. Head conicaly produced; tegminae attenuated caudad *Lucumius* Metcalf and Bruner
1. Head not conical; tegminae broadly rounded caudad ---------- 2
2. Crown elongate; male aedeagus simple with a pair of posterior processes----------
Hadria Metcalf and Bruner
2. Crown usually much broader than long; male aedeagus complex with an asymmetrical process --*Arezzia* Metcalf and Bruner

MORPHOLOGY

In the past emphasis has been laid on the shape and relative proportions of the crown, the position of the ocelli, the character of the venation and the external genitalia especially in the differentiation of the genera and species. In our opinion more emphasis must be placed in the future on the finer details of the venation and the internal genitalia. For that reason careful drawings have been made of the internal male genitalia of all the species considered in this paper where males were available. Drawings of the head characters and external genitalia are also included.

Certain terms which are used in this paper need to be defined. The head of an insect may be considered as an elongate six-sided box. The surfaces can then be named without reference to their morphological composition which will vary in the different families. The dorsal surface is called the crown in this paper not the vertex as it contains other elements besides the vertex. The anterior surface is called the face. In the cicadellids it is made up largely of the clypeus and anteclypeus. The lateral surfaces are called the cheeks. They are composed largely of the genae and mandibular sclerites (lorae). The ventral surface is the oral surface and the posterior surface is the base.

The anterior wings are the tegminae. They are fairly heavily chitenized in the cicadellids and are divided into three general areas - the anterior (costal or ventral) basal, corium; the posterior (anal or dorsal) clavus; and the apical membrane which is more or less translucent. The corium contains four principal veins, the costa, along the costal margin, the radius, the media and the cubitus anterior. The cubitus posterior separates the corium from the clavus. The membrane is usually

occupied by the apical cells formed by simple cross veins between the principal longitudinal veins or by branching of these veins. Due to the fact that the tegminae are relatively opaque in cicadellids the venation is frequently obscured but is usually distinct if viewed from the inner surface.

The female genitalia are of the usual homopterous design. The shape of the last ventral segment is specifically distinct. The genitalia proper consist of the swollen pygofers, the sheaths of the ovipositors and the ovipositors.

The male genitalia are complicated. The shape of the last ventral segment is not distinctive. Apically there is the median unpaired valve, sometimes concealed by the last ventral segment, sometimes absent; the paired genital plates and the pygofers. The relative shapes, sizes and details of these structures seem to be specific. The internal male genitalia are very complicated. They consist of a pair of genital styles and an unpared aedeagus. The aedeagus is made up of: A basal connective which unites it to the styles; a basal shaft; and, typically, a pair of dorsal processes; a pair of ventral processes; a pair of posterior processes and an apical lobe. So far as the writers are aware the characters of the internal male genitalia are always distinctive. And if considered in their broader aspects may give good characters for the distinction of generic and subgeneric groups.

NOMENCLATURE

In practically all groups of insects there is much confusion in nomenclature due in great part to the inaccessibility of the literature and frequently to a failure to apply the strict rules of nomenclature as laid down by the International Zoological Congress and elaborated by Banks and Caudell and the British National Entomological Commission. There has been a failure also to recognize the importance of correctly established genotypes.

The confusion in the use of the names *Tettigonia* and *Cicadella* is a case in point. As nearly as we can determine, the facts in this case are as follows:

Linne (1767a: 692-703) divided the genus *Gryllus* into a number of subgenera one of which he called *Tettigonia*. These

are apparently genuine Orthoptera. In 1762, 1766 and 1799 Geoffroy (1762a: 429) contrasted *Cicada* with *Tetigonia* (sic) but he did not follow binary nomenclature and mentions no species as belonging to *Tetigonia,* therefore, this name has no standing today. Fabricius (1775a: 678) used the name *Tettigonia* for the larger Homoptera which we now place in the Family CICADIDAE and the name *Cicada* for all the smaller Homoptera now placed in the membracids, cercopids, jassids and fulgorids. In this he was not followed by subsequent writers who followed Olivier (1789a: 24) using *Cicada* for the members of the Family CICADIDAE and *Tettigonia* for jassids. This in general was followed down to about 1900 with the genus *Tettigonia* being more and more restricted and used with *Cicada viridis* Linne as the implied type. In 1900 Kirkadly tried to revive the spelling used by Geoffroy but Jacobi (1904a: 778) proposed the new name *Tettigoniella* to replace the name *Tettigonia* Olivier and subsequent writers. Jacobi does not give a definite type for *Tettigoniella* but his reference to "*Tetigonia* Geof. fur *Cicada viridis* L." would lead one to believe that he intended *C. viridis* as the type of *Tettigoniella.* This is definitely stated by Distant (1908a: 516).

In 1916a: 66 and 1917b: 595 Van Duzee receive the name *Cicadella* crediting it to Latreille 1817a: 406 and placing *Tetigonia Geof., Tettigonia* Oliv. and *Tettigoniella* Jac. as synonyms giving as the orthotype *C. viridis* Linne. This is not correct, however, as Latreille (1817a: 400) divided the Homoptera into three families: 1) Cicadaires, 2) Aphidieus, and 3) Gallinsectes. The first of these was divided into three groups not genera "Cigales proprement dites" genus *Cicada* Oliv.; "Les autres Cicadaires" genera *Fulgora* Linn., *Flata, Issus, Derba* and *Delphax;* and "Les Cicadelles (Cicadella)" with the genera *Ledra* Fab., *Membracis* Fab., *Cercopis* Fab., and *Tettigonia* including the genera *Cicada* Fab. and *Iassus* Fab. Thus *Cicadella* would include all the members of the leafhoppers except the LEDRIDAE. No mention is made of *C. viridis* Linne. This same scheme was followed by Latreille (1829a: 209) except that the genera *Otiocerus* Kirby, *Lystra* Fab., *Cixius* Latr., *Poeciloptera* Latr., *Anotia* Kirby and *Asiraca* Latr., are added to the "Cicadaires (muettes)" and the genera *Tragopa* Latr., *Darnis* Fab., *Bocydium* Latr., *Centrotus* Fab., *Aetalion* Latr., *Ciccus* Latr., *Eulopa* (sic) Fall., *Eupelix* Germ., *Penthimia*

Germ., *Jassus* Fab., and "Les Cicadelles propes ou Tettigones"" (Tettigonia Oliv., Germ.— Cicada Linn., Fab.) are added. There is still no mention of *Cicada viridis* in any way. So far as we can discover this general scheme was used by the various translators of Cuvier's "Le Regne Animal". But Blanchard (1849a: pl. 99) gives in the explanation "Genre Cicadelle, *Cicadella* Latr. *Tettigonia* Oliv. Fig. 6 *Tettigonia viridis* Linn, and the name *Tettigonia viridis* was repeated on the plate.

In 1802 Latreille (1802a: 261) divided the genus *Tettigonia* into two divisions with *Cicada cuspidata* F. in one and *Cicada viridis* L. and *Cicada lanio* F. in the other.

In 1806 Dumeril (1806a: 267) gives a key to the genera of Homoptera including *Cicadella* which is briefly described on the preceding page. In 1817 Dumeril (1817b: 189) gives a good definition of the genus *Cicadella* and lists four species *C. vittata, C. viridis, C. interrupta* and *C. ulmi.* Dumeril has page priority over Latreille and Dumeril definitely indicated *Cicadella* as a genus, therefore, it clearly has priority. Sherborn (1925a: 1273) accepts this. *Cicadella* Dumeril will have as its logotype *Cicada viridis* Linne, a palearctic species.

The genotypes of the other genera are indicated under the discussion of each genus.

KEY TO THE SPECIES OF CUBAN *CICADELLIDAE*

A. Apical portion of tegminae behind clavus more or less reticulate-veined; head acutely angular.
  B. Crown flattened with definite margins, largely pale; face in profile nearly straight ------ *Draeculacephala cubana* Metcalf and Bruner
  BB. Crown convex with indefinite, rounded margins, largely rufous; face inflated
    C. With many small reticulations on the apex of tegminae ------ *Carneocephala flaviceps* Riley
    CC. With a few coarse reticulations on apex of tegminae ----- *Carneocephala reticulata* Signoret

AA. Apical portion of tegminae without reticulate veins; head usually not distinctly angular.
  B. Abdomen black or brownish above.
    C. Species mainly green above ---------- 1
      1. Pronotum and crown marked with black and yellowish transverse fascia; face, at least in female, entirely or in part bright rufous ---------- 2

1. Pronotum and crown without transverse fascia; mainly green and yellow above___. 3
2. Pronotum with anterior margin broadly bright rufous; tegminae, with distinct black stripes along veins; one long outer anteapical cell ____*Kolla fasciata* Walker
2. Pronotum with anterior margin black; tegminae with narrow black lines along veins; one somewhat shorter outer anteapical cell_____*Kolla carabela* Metcalf and Bruner
3. Head about as wide as pronotum, crown somewhat pointed, bright yellow marked with regular geometrical design in narrow black lines; tegminae with only one claval vein distinct; clear grass green without markings; face largely black transversely striped above with pale yellow; anteclypeus of female below with prominent angle; antenae normal_____ *Hortensia similis* Walker
3. Head distinctly narrower than pronotum; crown much shorter and more obtuse than in foregoing, bright yellow marked with heavy, simpler design in black; ocelli placed in center of disc, relatively close together; tegminae with two claval veins distinct; green, marked along longitudinal veins with narrow black stripes; face largely pale without transverse bands, a black median spot above on clypeus, this very flat without angle below; antennae relatively long *Hortensia filicis* Metcalf and Bruner

CC. Species not mainly green above_____ 1

1. Above mainly black heavily marked with paler longitudinal stripes or blotches; below largely yellow; two subequal anteapical cells; species of large or medium size _____ 2
1. Above the greyish or fuscous brown, size small, less than 5 mm._____ 3
2. Above black with pale, bright blue, irregular longitudinal markings on pronotum and tegminae; below deep yellow, face heavily marked with fuscous; size relatively large, length 8.75 mm_____ ____*Hadria balloui* Metcalf and Bruner.
2. Above mainly black with slate grey variable stripes, sometimes washed along

dorsum with yellow, orange or greenish yellow, below light yellow_____
Hadria convertibilis Metcalf and Bruner

2. Above mainly black with rows of numerous blue-grey elongated spots on tegminae; below yellow; face heavily marked with black, legs orange-brown; larger than foregoing, length 7-8 mm_____
Hadria convertibilis roigi Metcalf and Bruner.

3. Crown and pronotum vittate with dark brown; radius branched no inner anteapical cell _____
Entogonia inexpectata Metcalf and Bruner.

3. Crown and pronotum not vittate; radius not branched, a larger inner anteapical cell_____*Ciminius harti* Ball

BB. Abdomen red or bright crimson above.

C. Mainly yellowish or greyish white and pink, vittate with black or fuscous; three rather large anteapical cells in tegminae 1

1. Form elongate; crown horizontal, conspicuosly sculptured; anteclypeus bent backward forming promintent angle near center; tegminae with the three anteapical cells of about the same length; genital segment of female produced behind into point, without incision_____
Poeciloscarta cardini Metcalf and Bruner.

1. Form relatively stout, crown gently sloping to face, nearly smooth; anteclypeus forming nearly even curve with clypeus, the inner anteapical cell about twice as long as other two; genital segment of female with small notch at apex_____ 2

2. Head short and very broad; tegminae washed on lower surface with red and brown,usually no distinct yellow areas above except along costal margin; apex of genital segment with small shallow notch
Poeciloscarta laticeps Metcalf and Bruner

2. Head usually slightly longer and narrower than above; tegminae on lower surface washed uniformly with red, above often marked with pale yellow especially on clavus, apex of genital segment with small u-shaped notch _____ 3

3. Crown and pronotum buff striped with black, disc of latter on either side of

median pair of stripes often suffused with deep yellow or orange red; face with transverse black dashes between two vertical stripes on either side; legs buff, often more or less embrowned; apex of genital segment with narrow u-shaped notch; length 6.1 - 6.5 mm.—*Poeciloscarta histrio* Fabricius

3. Crown and pronotum paler, glossy, black stripes broader, usually continuous, disc of pronotum on either side of median pair of stripes deep orange red; face without transverse black dashes on either side; femora dull orange or red; apex of genital segment with u-shaped notch; size distinctly larger, length 6.5 - 7.5 mm.—*Poecilloscarta histrio* var. *baraguensis* Metcalf and Bruner

CC. Not marked as above; two rather small anteapical cells or none ---------- 1

1, Distinctly vittate longitudinally with black or fuscous on crown and pronotum- 2

1. Without distinct black vittae on crown and pronotum ---------- 4

2. Four broad black vittae on pronotum---- 3

2. Five black vittae on pronotum, ground color of crown and thorax above orange yellow to greenish yellow; head somewhat pointed ----------*Arezzia omaja* Metcalf and Bruner

3. Above light blue and black: two broad black median vittae from apex of head to lateral angles of scutellum; black stripes on pronotum from behind eyes not percurrent; tegminae black with large, light blue, elongated blotches; head somewhat produced and distinctly pointed ----*Hortensia gundlachiana* Metcalf and Bruner

3. Above mainly pink, vittate; two broad black median vittae from apex of head to lateral angles of scutellum, the latter with black median mark at base; black vittae on pronotum from behind eyes percurrent; tegminae pink and bluish grey marked with black along veins; head somewhat produced, rather narrowly rounded in front, but not distinctly pointed-------- *Hortensia conciliata* Metcalf and Bruner

4. Crown and pronotum, at least anterior

portion of latter, with vermiculate or labyrinthine markings; two small or very small anteapical cells 5

4. Not so marked 12
5. Tegminae and pronotum largely green... 6
5. No green above 10
6. The head, anterior margin of pronotum and scutellum yellow inscribed with black 7
6. The head, anterior margin of pronotum and scutellum pale buff lightly inscribed with thin brown lines, the remainder of pronotum green heavily mottled with dark brown; tegminae green without markings; face buffy mottled with brown or the reverse, no black median spot above *Arezzia viridipennis* Metcalf and Bruner
7. Size moderate, length 6.0 - 7.3 mm..... 8
7. Size relatively large, length 7.7 - 9.0 mm.; head very short, broad and rounded anteriorly, heavily inscribed with black above in labyrinthine pattern, face strongly marked on sides with fuscous brown and with large irregular fuscous median spot above ....*Arezzia maestralis* Metcalf and Bruner
8. Face with dark median spot above; tegminae without distinct, white subapical transverse band 9
8. Face without a dark median spot above; head somewhat produced and obtusely pointed, labyrinthine pattern above of numerous mostly anastomosing narrow black lines; tegminae with a distinct, milky white, subapical transverse band; below typically light lemon yellow..... *Hadria labyrinthica* Metcalf and Bruner
9. General coloration above bright green, the black markings narrow; head short and broad, nearly rounded in front; face rounded in even curve to anteclypeus; genital segment of female moderately produced behind in center, the apex with shallow incision..... *Hadria cubana* Metcalf and Bruner
9. General coloration above dull greyish green, more heavily inscribed with black; head short but rather narrowly rounded in front; face with disc somewhat flattened; genital segment of female considerably produced behind into moderately acute

point, with extreme apex obtuse; size larger, females exceeding 7mm.____*Hadria trinitalis* Metcalf and Bruner

10. Crown short, broad and broadly rounded to face; face with a single median black spot above _____ 11

10. Crown triangular produced; face with a pair of black spots above _____*Lucumius triangularis* Metcalf and Bruner

11. Above mainly brown heavily marked with black; the black markings over either side of crown and pronotum forming a somewhat labyrinthine pattern of broken irregular stripes, arranged longitudinally; tegminae marked with black along veins; genital segment of female produced into point behind, the apex obtuse___*Arezzia rangeliana* Metcalf andBruner

11. Above mainly brown, darker on head and anterior margin of pronotum, which are covered by network of very irregular somewhat vermiculate, buffy lines and spots almost as broad as intervening dark areas; arranged transversely on disc of pronotum; tegminae without black markings, irrogate with testaceous; genital segment of female produced behind into a long acute point, the apex with u-shaped notch____*Arezzia anachoreta* Metcalf and Bruner

12. Above pale purplish red marked with large deep orange macullae delimited by dark undulating lines; legs and venter stramineus_____ *Hadria oteroi* Metcalf and Bruner

12. Above mainly dull wine red with few pale buffy markings on head and thorax, chiefly longitudinal, these for most part with broad indefinite fuscous borders; legs reddish, more or less infuscate_____ *Arezzia baracoa* Metcalf and Brüner

DRAECULACEPHALA BALL

(Ball 1901b: 66)

Orthotype *Tettigonia mollipes* Say 1830b: 312.

This is a genus of some 15 known species most of which come from the United States. One species *D. lenticula* Ball is

known only from Mexico and Honduras, and another species *D. minor* Walk. has been reported from the Southern States, Mexico, Guatemala and the West Indies. Most of the species resemble each other very closely having a rather acute triangular crown, usually longer than the pronotum. In the more northern species the crown is often broadly rounded. Face flat. Well developed wing venation with the apical area strongly reticulate. Most of the species are largely dull greenish in color with the crown, anterior margin of the pronotum and the scutellum dull yellow. Some of the species are straw yellow.

Ball (1927c) has recently reviewed the North American species and given a key for these forms. We cannot agree with his statement that the internal genitalia are not diagnostic. We believe that these furnish not only reliable specific but generic characters as well.

Draeculacephala cubana n. sp. Figs. 23, 48.

This species bears a superficial resemblance to the North American *mollipes*, but the crown of the female is longer and more acute and the male genitalia are entirely different.

The general color of the tegminae and the disc of the pronotum dark grass green. The crown and the anterior margin of the pronotum and scutellum straw yellow; crown faintly marked with a series of elongate brown dashes forming indistinct lines; ocelli and eyes conspicuously marked with black. Face fuscous, somewhat darker in the male and marked with a series of pale arcs; beneath dull yellow, more or less infuscated often completely infuscated in the male. Tegminae grass green, venation paler, sometimes blue, costal margin not abruptly paler, the claval furrow concolorus.

Crown of the male and female distinctly longer than the pronotum, acute in both sexes; lateral margins nearly straight. Face nearly straight in profile.

Last ventral segment of the female triangular, the lateral margins nearly straight; the pygofers rather robust. Male genitalia: Last ventral segment broadly circular in outline; plates elongate, longer than the pygofers.

Length: Female average 8.5 mm., male average 6.5 mm.

Holotype: Female, Santiago de las Vegas, April 20, 1916, S. C. Bruner.

Allotype: Male, same locality.

Paratypes: Numerous specimens. Santiago de las Vegas, Manzanillo, Havana, Casa Baraqua, Miyanda, Carabella Grande, Sto. Tomás, Isla de Pinos, S. German, Buenos Aires.

CARNEOCEPHALA BALL
(Ball 1927c: 39)

Orthotype *Draeculacephala floridana* Ball 1901b:72.

In this genus the tegminae are reticulate apically but the crown is conically produced and the face is inflated. Seven species are known from the United States two of these are reported from Mexico and the West Indias also, and an eighth species is known from Central America.

Carneocephala reticulata Sign. Fig. 25

Tettigonia reticulata Signoret 1854a:22.

Originally described from Cuba as *Tettigonia reticulata* Signoret (1854a:22), the species has since been greatly confused in the literature, apparently due to the fact that the larger *Carneocephala flaviceps* Riley of continental North America was thought to be the same. The latter name is attached to the specimens in the Gundlach Museum in Havana (No. 284). Dr. P. Valdés Raqués (1910,) published a list of the insects in this museum transcribing the name as *flavipes* by mistake. It was reported as *Draeculacephala reticulata* by Bruner in 1922 and as *D. sagittifera* Uhler by Dr. Osborn in 1926. Nottingham (1932a:104) has recently pointed out that the latter while similar is not identical with the Cuban species. The genus *Carneocephala* was erected in 1927 by Ball for four species formely included under *Draeculacephala*.

C.reticulata is widely distributed in Cuba and specimens have been taken in all of the provinces. It usually occurs on small grasses and is rather a common species. Dr. Osborn found it particularly on Bermuda grass (*Cynodon dactylon* (L.) Pers.).

Carneocephala flaviceps Riley. Fig. 24.

Tettigonia flaviceps Riley 1880a:78.

This species is common throughout the Southern States. A single female specimen was taken at Santiago de las Vegas without further data.

HORTENSIA GEN. N.

Orthotype *Tettigonia similis* Walker 1851b:769.

Head including the eyes somewhat narrower than pronotum, somewhat conically produced; eyes not prominent; crown smooth. Pronotum distinctly broader than long; the anterior margin nearly a uniform curve from the posterior humeral angles; posterior margin nearly straight. Mesonotum large. Tegminae narrow with three large anteapical cells. Aedeagus simple with a pair of short lobe-like processes at the base of the apical lobe.

Hortensia filicis n. sp. Figs. 2, 26.

A rather small species with head obtusely angular and somewhat narrower than pronotum; bright green and yellow, the vertex heavily marked with black, veins of tegminae narrowly black and abdomen fuscous above.

Head rather short; crown obtusely angular, sides slightly rounded, more so in male, about one and one-half times as broad as long, slightly more than half the length of pronotum, shorter in male; eyes not prominent in line wth crown; ocelli in center of disc, nearer together than usual in *Cicadella;* antennae rather long, segment two elongate, apex visible from above; face with disc very flat, almost perfectly straight in profile, forming angle of 70-75 degress with vertex; very broadly and nearly evenly curved from anteclypeus to apex, slightly prominent near center. Pronotum about one-tenth broader than head across eyes, nearly six-tenths as long as broad, surface smooth, a shallow depression behind anterior margin, posterior margin nearly straight. Tegminae with three relatively large oblong anteapical cells, the inner shorter;venation resembling that of *H. similis* Walk. except for presence of two veins.

Genitalia: Female, last ventral segment somewhat more than twice as long as preceding, posterior margin angularly produced, surmounted by a short rather acute median tooth; pygofers with pale or brownish bristles, mostly on sides behind

ventral margin. Male last ventral segment nearly twice as broad as long, about a third longer than preceding, posterior margin nearly straight or slightly convex; plates rather small and broad basally, apices long and relatively thick, exterior margins with regular row of long pale bristles. Valve very small, posterior margin circular, frequently entirely concealed by the last ventral segment.

Color: Crown shining yellow marked with heavy regular design in black, about equal in extent to yellow, including an area on either side of apex, a patch on either side of disc from and including ocelli to or near posterior margin, an inverted V—shaped median mark from base to beyond level of ocelli; black markings usually connected with each other. Pronotum largely bright green with anterior and lateral margins for about one-fourth of length irregularly yellow, posterior margin very narrowly yellow, a small, roughly oval, oblique black spot on either side of disc at anterior border of green area and a similar smaller spot in front of each in yellow area sometimes connected or obsolete; a small, usually elongated black mark from behind posterior angle of eyes. Scutellum yellow, a black vitta on each side of center from base to deep transverse suture, where apices are more or less prolonged inwards; postscutellum somewhat paler. Tegminae bright green marked over longitudinal veins with narrow, even, black stripes; transverse veins and short indefinite band behind outer apical margin opaque whitish; apical area with inner half to apex of clavus subhyaline, pale fuscous. Below largely pale buffy yellow marked with black and fuscous brown. Face with elongate oval central area from crown nearly to anteclypeus usually more distinctly yellow, a large rounded median black spot above near margin, black of crown continued on either side of this, fading gradually below to form an indefinite pale brown band on sides, converging to base of anteclypeus; thence continued as broad paler median band; darker, narrow, oblique stripes at times faintly indicated in brown on sides of face with a fuscous black stripe along inner margin; an irregular dark patch on genae beneath eyes. Pronotum with large fuscous patch on sides behind eyes. Mesosternum largely fuscous. Legs and rostrum pale, basal joints of latter externally and claws somewhat embrowned. Venter of female, including ovipositor, pale buffy yellow; apical tooth on genital segment slightly darker; venter of male usually infuscate, except plates

which are usually much paler. Abdomen above fuscous. Wings infuscated.

Length: 5.5 - 6 mm.

Holotype: Female, Palma Mocha Peak, Sierra Maestra Mts., Oriente Province, altitude 3,000—4,250 ft., July 10 - 20, 1922, C. H. Ballou and S. C. Bruner; on ferns (E. E. A. de Cuba No. 8896).

Allotype: Male, Sierra Maestra Mts., altitude 3,500 - 4,500 ft.

Paratypes: Eleven specimens, same data as types. One female, Pico Turquino, July 20, 1922, S. C. Bruner and C. H. Ballou, altitude 5,000 — 5,500 ft.

This species is strikingly different structurally from all other species found in Cuba. The venation of tegminae is very similar to that of *H. similis* Walk. The insect was swept from ferns growing along shady, steep-banked, mountain brooks.

Hortensia similis Walk. Figs. 1, 31, 49.

Tettigonia similis Walker 1851b: 769

This widely distributed species was described from North America, has been reported from Florida, Cuba, Jamaica, St. Vincent, Trinidad, Puerto Rico, Dominica, Mexico, Central America, Venezuela, Brazil, and Argentina; and occurs abundantly on grasses throughout Cuba, specimens having been collected in many localities in all provinces including the Trinidad Mountains up to at least 2,500 ft., and on the Zapata Peninsula.

It differs from the other species of Cuban *Cicadellidae* in having only one claval vein conspicuous and by the peculiar form of the clypeus of the females, this being directed abruptly backward, a short distance before the anteclypeus, thus forming a conspicuous obtuse angle in lateral view. In the males this is barely indicated. There is considerable variation in size, Cuban specimens measuring 4 — 6 mm. in length, the males being much the smaller.

Hortensia gundlachiana n. sp. Fig. 5.

Readily distinguishable from other species occurring in Cuba by the very striking coloration of light blue, yellowish green and black; and by the well produced, narrow, pointed head.

Head considerably produced before eyes with the apex pointed, the sides somewhat arcuate, more so in the female;

crown smooth, surface polished, slightly tumid in center behind ocelli, about three-fourths as long as wide basally, slightly more than half as long as pronotum, sides slightly sinuate in front of eyes which are well rounded externally and somewhat protruding. Pronotum behind slightly wider than head across eyes, only about two-thirds as broad as long, posterior margin very slightly concave, a very shallow transverse depression behind anterior border, lateral margins straight, converging cephalad. Clypeus narrow, nearly straight in lateral view, the disc flattened; antennae long. Rostrum very long, reaching posterior coxae. Tegminae rather narrow with three large, elongate anteapical cells, the inner cell about one-fourth shorter than outer two.

Genitalia: Female, last ventral segment long, about three and one-half times as long as preceding, the posterior margin greatly produced into a long, narrow, acute tooth; pygofers greyish white along ventral margin with sparse growth of dark bristles. Male plates with apex produced into a very long narrow process about as long as basal portion; margins of latter with fine long hairs.

Color: Above largely black with broad, sharply defined vittae and longitudinal blotches of light or pale blue and yellowish green. Crown largely covered by two broad, black, longitudinal vittae across disc, the narrower median vitta very pale blue and a buffy vitta next to each eye. Pronotum light blue, becoming very pale cephalad, the disc crossed by two straight, percurrent black vittae, the margins of these somewhat uneven, and a similar but narrower black vitta from behind each eye extending to about the center. Scutellum with center pale, the sides covered by a continuation of black vittae of pronotum; postscutellum brown. Tegminae black marked with paler as follows: Clavus with a large elongated blotch of yellowish green to greenish yellow extending obliquely caudad from anterior margin to about center; a similar, narrower band with rounded ends extending backward from below apex of this to near apex; *corium* largely covered by five large, light to somewhat pale blue, elongated blotches with a short, broad, paler, preapical fascia. Below largely black; clypeus and anteclypeus shining black, a continuation of the pale buffy spot above lorae. Thorax dull black, the legs dull orange yellow. Venter largely dull black, hind margins of segments yellow, and in female with the lateral margins also more or less so; pygofers largely black, pale ventrally. Abdomen above black. Wings strongly infuscated.

Length: 6.7 — 7.1 mm.

Holotype: Female and Allotype, Male, El Yunque Mt., Baracoa, Oriente Province, elevation 300 meters, June 10, 1935, F. de Zayas.

Paratype: One female from the same locality in the collection of the collector.

There is a specimen of *H. gundlachiana* in the Gundlach Museum labeled "361, Tettigonia sp." Gundlach records that this was also collected at Baracoa.

This species appears to be related to *Cicadella* (*Entogonia*) *constans* Walk. of Haiti, as figured and described by Dozier (1931 a: 6).

Hortensia conciliata n. sp. Fig. 6.

A rather small species with head considerably produced but well rounded in front, the crown, pronotum and scutellum brightly colored with broad longitudinal black and pink vittae.

Head rather strongly produced beyond eyes, well rounded in front, crown somewhat flattened, nearly four-fifths as long as broad at base, about five-sixths as long as pronotum (in female), sides not appreciably sinuate in front of eyes. Eyes of moderate size, slightly protruding. Pronotum as broad as head across eyes, short, less than sixth-tenths as long as broad, posterior margin shallowly, but distinctly concave, a light transverse depression behind anterior border. Postscutellum rather broad, apparently with a longitudinal median depression.

Color: Crown rich dull buffy pink, marked on each side with a broad black vitta with very uneven borders, this bifurcates behind ocelli, one branch continuing straight to posterior margin, the other narrower, continuing obliquely to internal angle of eye, the central pink area somewhat broader than lateral black vittae; ocelli yellowish surrounded by a narrow pale border. Pronotum buffy pink, concolorous with head, marked with four very broad black percurrent, uneven, vittae, thus forming alternate black and pink bands of about the same width, the two median vittae narrower anteriorly and joining those on crown; the posterior margin of pronotum appears narrowly pale pinkish. Scutellum pink and black concolorous with pronotum, median vitta from base to transverse impression and lateral angles black, the latter a continuation of two median vittae of

pronotum; postscutellum pale. Tegminae mutilated, basal half marked with black stripes along veins, the intervening pale areas pinkish and bluish grey. Legs pale testaceous. Abdomen red above.

Length: 5.50 mm., approximately.

Holotype; Female; "Guamacas; Cuba", Dr. J. Gundlach, in the Gundlach Museum, Havana, No. 277.

The foregoing incomplete description and accompanying figure were made from a single somewhat faded specimen through the glass cover of a sealed box in the Gundlach collection. This specimen is labeled "*Tettigonia conciliata* Uhler — 277". Gundlach records this number as collected at "Gumacas; Cuba". The latter locality is evidently Santiago de Cuba. Pedro Valdes Ragues published (1910) the manuscript name *conciliata* and the number of the specimen in Gundlachs collection with the observation "4mm., light brown, reddish".

No other species is known from Cuba with which this rare or very local form could be confused. It is apparently related to *Arezzia omaja* n. sp.

Poeciloscarta Stal

(Stal 1869a: 73)

Logotype *Cicada histrio* Fabricius 1794 a: 34.

This genus was established by Stal (1869a: 73) as a subgenus of *Tettigonia* Oliv. for the following species: *cardinalis* Fabr., *cruenta* Fabr., *quadriguttata* Fabr., *marginella* Fabr., *laeta* Fabr., *pudica* Fabr., *quadrifasciata* Linn., *moesta* Fabr., *lyncea* Fabr., *histrio* Fabr., *tristis* Fabr., *suturalis* Fabr., and *pauperata* Fabr., all from South America and the West Indies. Van Duzee (1894a: 271) raised this group to generic rank but included only *lyncea* and *histrio*. Melichar (1926 a: 342) confines this genus to "Arten aus Madagaskar und Afrika" and errects a new genus *Cardioscarta* for "Arten aus Amerika". In 1932 a:285 he described the genus *Cardioscarta* and gave a key to and descriptions of 90 species, including three of the above, 52 previously described species and 35 new species.

We have selected *Cicada histrio* Fabricius (1794a:34) as the type of the genus *Poeciloscarta* Stal.

In this genus the head is broad, broader than the pronotum; blunt anteriorally; eyes prominent; the crown short, somewhat uneven. Pronotum nearly quadrangular. Tegminae with three

large anteapical cells, the radial and medial nearly quadrate; claval veins not united. Anterior tibiae ciliate.

In this genus the aedeagus is provided with a pair of elongate ventral processes.

Poeciloscarta histrio Fabr. Figs. 3, 33, 50.

Cicada histrio Fabricius 1794a:34

Tettigonia robusta Walker 1851b:777.

This species was described by Fabricius without definite locality. Walker redescribed it as *Tettigonia robusta*, also without definite locality. It is apparently one of the most common species in Cuba. It is a species of moderate size and robust form with short, broad, well rounded head; above largely buff, more or less pinkish, with dull pink tegminae, marked throughout rather evenly with strong black longitudinal stripes.

Head short and broad, somewhat variable in form; crown nearly evenly rounded in front to slightly triangular, concave before eyes, moderately long, shorter in male, slightly more than half as long as pronotum; eyes prominent; antennae of moderate length, apex of second segment visible from above; clypeus moderately tumid, very slightly flattened. Pronotum approximately three-fourths as broad as head across eyes, nearly two-thirds as long as broad, posterior margin slightly concave in center. Tegminae broadly rounded at apex, appendix relatively broad with three large anteapical cells, the inner cell larger, elongated, about twice the length of two preceding cells.

Genitalia: Female, last ventral segment three to five times as long as preceding, posterior margin produced into somewhat acute point, sides slightly convex, apex with small distinct, narrowly U-shaped notch, usually about one-half as wide as deep; pygofers with few pale brown bristles, mostly in irregular band on either side of ventral margin. Male, last ventral segment broader than long, about one-third longer than preceding segment, posterior margin broadly concave, plates small, extending about half the length of pygofers, relatively slender with elongated apices, external margin without row of large bristles, with few minute brownish bristles intermixed with fine pale hairs.

Color: Above, crown buff, often suffused with pink, especially on either side of median line, marked with four strong longitudinal, rather evenly spaced, black vittae; the two inner

vittae usually percurrent, unbroken, parallel, margins somewhat undulating; intermediate vittae much more uneven, broken before ocelli, a narrow fascia connects inner and intermediate vittae anterior to ocellus; a narow incomplete median vitta often present; eyes dark brown. Pronotum buff, sometimes suffused with pink, the anterior and lateral margins broadly paler, the disc crossed by four, strong, evenly spaced, nearly percurrent, black fasciae, the space between the inner and intermediate fasciae frequently washed with very pale orange yellow; an elongated black patch behind each eye extending about two-thirds the distance to posterior margin. Scutellum and post-scutellum buff, the inner pair of fasciae of pronotum continued over scutellum to transverse impressed line. Tegminae below entirely red except translucent apical area, appearing pale to deep dull pink above, heavily marked with black longitudinal veins to base of anteapical cells, cross veins at bases of anteapical cells irregularly marked with black, costal area from base largely washed with opaque yellow; cells bordering claval suture and inner angle of clavus usually suffused with pale yellow; translucent apical area dark fuscous divided by a paler transverse fascia preceded by a variable transparent white patch next to costal margin. Below pale buff marked with black, head and pleurae often suffused in part with pink. Clypeus with two longitudinal black stripes on either side which unite below, then continue inwards unite again on base of anteclypeus and continues as a broad stripe to apex; the two inner stripes of clypeus often gradually broadened above, usually not connected with stripes on crown; lateral pair of stripes usually in part connected by numerous incomplete black dashes which often cross the uneven lateral stripes. Legs deep buff to brownish, a dusky streak on femora behind near apex and on corresponding portion of lower surface of tibiae. Each segment of abdomen below with a pair of fuscous black spots, last segment of female with similar large macula on disc, the apex embrowned; in male the dark maculae on sides of posterior ventral sclerites fuse behind at apex forming two or three broad arcs. Abdomen above bright crimson. Wings translucent brownish fuscous with darker veins.

Length: 6.1—6.5 mm.

Redescribed from numerous specimens from various localities throughout Cuba, including Taco Taco (E. E. A. de Cuba

No. 8772) and Sierra Rangel, Pinar del Rio Province; Santiago de las Vegas (E. E. A. de Cuba No. 10028), Havana Province; Peninsula de Zapata and Trinidad Mts., Santa Clara Province, Camaguey, Camaguey Province, Nagua (E. E. A. de Cuba No. 8893), Santiago de Cuba, San Nicolas and Baracoa, Oriente Province.

This common species occurs on a wide range of plants of different families, both cultivated and wild. Dr. J. C. Myers (1928d) refers to it as the Croton Leafhopper as he found it very abundant on *Codiaeum variegatum* (L.) Bl. near Cienfuegos, Cuba. The junior author has found adults and nymphs on a small composite weed, *Vernonia cinerea* (L.) Less. at Santiago de las Vegas. A. R. Otero found it breeding at the same locality on a garden plant, *Aloysia triphylla* (L. Her) Br., and we have specimens reared on *Ocimum bacilicum* L. by C. H. Ballou. It is also found occasionally hiding in the whorls of sugar cane leaves. At San Nicolas, Oriente, it was found rather numerous on coffee plants, *Coffea arabica* L.

The nymphs are suggestive of the adults being whitish and pale yellow heavily marked with black and dusky.

In order to fix as definitely as possible the identity of the present species specimens were sent to the British Museum and there very kindly compared with the type of *Tettigonia robusta* Walk. by Mr. W. E. China who found them conspecific. The latter was synonymized with *Tettigonia histrio* of Fabricius by Stal. This matter has already been considered by Myers in the paper cited above. While the present form is the same as that treated by the latter author and also that of the Gundlach Museum (labeled *Tettigonia robusta* Sign.) it is by no means certain that it is the species referred to as *histrio* by other recent authors. Osborn (1926c:340) speaks of *histrio* as having the lines on the tegminae interrupted but otherwise very similar to *sirena* Stal. However, the true *histrio* has the black lines on the tegminae relatively even and continuous. Furthermore, *sirena* is certainly very different from anything known in Cuba, or in Puerto Rico, from which Islands it has been reported in various recent publications. Stal described *sirena* (1864a:76) as an insect 8½ to 10 mm. in length with the abdomen fuscous above. *Poeciloscarta histrio* is much smaller (6-6½ mm.) with the abdomen bright crimson above. Fowler's illustration of *sirena* (1899d: Pl. 16, fig. 18) made from the type also indicates an entirely distinct species.

Poeciloscarta histrio var. *baraguensis* n. vr. Fig. 29.

In general plan of coloration, form and structure resembling *P. histrio* Fabr. but readily distinguishable by heavier black markings, brighter colors and by distinctly larger size.

Genitalia: External genitalia not appreciably different from *histrio* except that notch in produced apical margin of last ventral segment of female is relatively broader in the specimens at hand, this being intermediate in form between that of *laticeps* and *histrio*.

Color: The black stripes strongly marked, broader than in *histrio*, the four on disc of pronotum usually percurrent and rather uniform in width. The ground color of head and thorax pale, glossy, the disc of pronotum on either side of center, between inner and intermediate stripes, and lateral angles of scutellum heavily washed with orange or orange red. Tegminae with costal area and clavus externally deep yellow. Below resembling *histrio* except for stronger black markings, the two inner stripes of face usually continuous with those on crown, not broken at apex of head, and without transverse row of narrow black dashes between these and intermediate vertical stripes. Legs with femora orange or light red, brighter on the posterior pair and contrasting with pale buff tibiae.

Length: 6.5 - 7.5 mm.

Holotype: Female, Central Baragua, Camagüey, July 26-27, 1927, C. F. Stahl and S. C. Bruner.

Allotype: Male, same locality.

Paratypes: Seven specimens from same locality, and Isla de Pinos, March 1, 1923, S. C. Bruner.

This relatively large, strikingly marked form appears very different from the common *histrio;* the internal genitalia are practically identical. Its food plant has not been determined.

Poeciloscarta cardini n. sp. Figs. 8, 27.

A rather elongate, subparallel species of moderate size with prominent eyes, horizontal sculptured vertex and narrow impressed pronotum; unevenly striped with black above, the head and thorax buff, the tegminae rose pink; abdomen red above.

Head somewhat produced, narrowly rounded or slightly pointed in front; crown horizontal, a longitudinal median

depression at base and broader lateral depression next to eyes, the apex slightly prominent above, about three-fourths as long as broad, about two-thirds as long as pronotum, shorter in male; eyes prominent, strongly rounded externally, not forming even curve with crown; antennae relatively long, nearly as long as head and thorax combined; face normal, disc slightly flattened, forming angle of about 55 degrees with crown; anteclypeus bent upward before center, forming a prominent obtuse angle in lateral view. Pronotum considerably narrower than head across eyes, about two-thirds as long as broad, a deep impression on either side in front, disc behind moderately convex, smooth, posterior margin nearly straight. Tegminae somewhat elongated with subparallel lateral margins, apex obtusely rounded, almost subtruncate, three large elongate anteapical cells of about same length.

Genitalia: Female, last ventral segment nearly two and one-half times as long as preceding, posterior margin produced, forming about a right angle, the apex with a short tooth; pygofers with few dark bristles behind ventral margin. Male, abdomen very small, last ventral segment transverse, slightly more than twice as broad as long, posterior margin straight; valve minute forming a nearly equilateral triangle; plates slender, about two and one-half times as long as last ventral segment, somewhat longer than pygofers, apices somewhat flattened, twisted and bent outward in dried specimens, external margins with few minute bristles only.

Color: Crown buff or pale yellow, often lightly washed with brown on either side of apex, with irregular black longitudinal markings as figured, leaving a broad median band and area between ocelli and eyes pale. Pronotum buff, often somewhat brownish, with six more or less broken and variable, broad, longitudinal black or fuscous stripes, the central stripes narrower and parallel; anterior margin often paler, the broad lateral margins pale yellow. Scutellum buff or pale yellow, a black mark on either side at base, narrowed behind and extending to transverse depression and there prolonged inwards; often a smaller median dark spot at base; postscutellum pale yellowish. Tegminae jasper red varying in intensity, sometimes with a lilac tint, marked along veins with broken black stripes and variable elongated blotches, intervening areas often washed with paler; an indefinite pale, broad, somewhat oblique transverse fascia usually distinguishable behind center preceded by darker

indefinite band; apical area lightly infuscated, translucent, preceded by pale macula on costal margin, disc before apical margin and around anal angle largely pale; commissure pale yellow. Below buff or yellowish white usually heavily marked with fuscous and brown. Face with row of four narrowly spaced large black spots across upper margin, the two central spots larger, continued from crown; a somewhat sinuate row of 6 to 9 oblique dark brown arcs on sides beneath lateral spots, these gradually shortened below and fused near apex, then united with broad fuscous brown median stripe, which is continued, gradually narrowed, to about center of anteclypeus. Lorae with inner margin broadly fuscous. Genae with elongate irregular fuscous area from lower margin of eyes to behind lorae. Thorax with large fuscous patches. Legs pale, usually with more or less distinct, incomplete, fuscous basal and preapical bands on femora; a row of small dark spots at base of spines on outer side of posterior tibiae and a similar row of smaller spots beneath; these markings largely obsolete on pale specimens. Female with sides of ventral sclerites, pygofers at base, and center of pleural sclerites more or less infuscated; genital segment with large fuscous median patch over base, apical margin embrowned the pygofers with sides more or less pinkish. Venter of male and plates somewhat infuscate. Abdomen above and lateral margins of venter bright crimson. Wings light fuscous.

Length: 7 - 8 mm.

Holotype: Female, Las Animas, Sierra Rangel Mts. Pinar del Rio Province, August 2, 1929, J. Acuña and S. C. Bruner.

Allotype: Male, Cienaga de Zapata, Santa Clara Prov., July 10, 1920, S. C. Bruner, on *Morinda roioc* Lin. (E. E. A. de Cuba No. 8548).

Paratypes: Specimens from Sierra Rangel, Pinar del Río, J. Acuña; Santiago de las Vegas, on *Terminalia catappa* Lin., A. R. Otero; Ceballos, Camagüey, P. Cardín; Baracoa, Oriente, S. C. Bruner and L. Bouclé; Nagua, Oriente Prov., July 29, 1922, S. C. Bruner and C. H. Ballou.

This unique form while widely distributed in Cuba is not commonly seen and usually only solitary individuals have been taken in sweeping woodland vegetation. It is apparently related to *Cicadella dubiosa* Dozier of Haiti, but may be easily distinguished by shorter vertex, distinct genitalia, and distinct markings and general coloration.

The species is dedicated to the former entomologist of the Cuban Experiment Station, the late Patrico Cardin, who collected the first specimen obtained.

Poeciloscarta laticeps n. sp. Figs. 7, 30.

Closely related and very similar to *Poeciloscarta histrio* Fabr., but having a somewhat shorter and broader head, narrower, more irregular and broken black vittae, these alternately thickened and narrowed on tegminae; general coloration browner, the tegminae eosine pink; genitalia distinct.

Head short and broad with prominent eyes; crown very broadly rounded anteriorally, somewhat more than twice as broad as long, about three-fiifth as long as pronotum, slightly shorter in male. Clypeus moderately tumid in lateral view forming a broad, nearly regular curve with anteclypeus. Pronotum only about four-fifths as broad as head across eyes, scarcely three-fifths as long as broad. Tegminae broadly rounded at apex, apical margin largely subtruncate, appendix unusually broad; three anteapical cells, the outer and intermediate cells rather small, roughly oval and subequal, the inner cell elongate, about twice the length of others.

Genitalia: Female, last ventral segment nearly three times as long as penultimate, posterior margin somewhat produced and gradually narrowed, the apex with a shallow, nearly evenly rounded notch, pygofers with few brownish bristles. Male, last ventral segment much broader than long, somewhat longer than penultimate, posterior margin straight; plates small, extending about two-thirds the length of pygofer, relatively narrow, tapering to slender apices, without regular row of conspicuous marginal bristles.

Color: Crown, pronotum and mesonotum pale buff above, marked with irregular black longitudinal vittae. Crown usually with a median line from base, broadened anteriorly, and not extending to apex, sometimes, reduced to a mere spot behind apex. Pronotum with black markings as follows: An inner pair of more or less continuous vittae extending from behind anterior margin to about four-fifths distance to hind margin, more approximate anteriorly; on either side of these an intermediate sub-parallel vitta of about same length, usually broken into spots anteriorly; a much broader and shorter vitta from behind eyes extending about two-thirds length of pronotum. Scutellum pale buff, with a broad black vitta on either side from base to slight-

ly beyond transverse impressed line, sometimes connected at apex by narrower fascia along impressed line; lateral angles often faintly orange; postscutellum buffy. Tegminae below light brown washed with rose red from base through disc to anteapical cells and through center of clavus showing on upper surface as pale brown and pink; veins narrowly marked with a large, transparent patch from costal margin including most of first anteapical cell, followed by transverse black or fuscous band which curves forward to apex of inner anteapical cell; remainder of apical area smoky hyaline except apical margin which is rather broadly fuscous black; costal area washed with opaque yellow over approximately anterior two-thirds. Below pale buffy yellow marked with black, the pleurae washed with yellow. Clypeus with two vertical black stripes on either side which originate near base, unite below at acute angle before apex, continue inward, fuse on base of anteclypeus and extend as a single broad band to apex; the two inner stripes of clypeus abruptly enlarged at upper extremity and there more approximate; each lateral pair of stripes connected by numerous, usually incomplete, oblique black dashes. Legs largely brownish buff; posterior tibiae usually washed with pale yellow; a dusky streak on femora behind near apex and on corresponding portion of lower surface of tibiae. Each segment of abdomen below with a pair of black spots in the female, these connected to form a black crescent in the male; last segment of female with a similar large broadly oval macula on disc, the posterior margin somewhat embrowned; the pleural sclerites with a median longitudinal fuscous dash. Abdomen above bright crimson. Wings largely pale brownish fuscous with darker veins.

Length: 6 - 6.5 mm.

Holotype: Female, El Cobre, Oriente Province, October 5, 1928, F. Silvestri and S. C. Bruner.

Allotype: Male, Omaja, Oriente, July 24, 1932, S. C. Bruner.

Paratypes: One female, Manacas, Santa Clara Province, S. C. Bruner; one female, Santiago de las Vegas, A. Otero, three males and five female Omaja, Oriente, S. C. Bruner; one female, Barrio Caobilla, Camegüey, June 23-25, J. Acuña; one female, Casa Baragua, June 26, C. F. Stahl and S. C. Bruner; one female and one male, S. Nicolas, Ote, July 20, S. C. Bruner on *Coffea arabica;* and one female, Jaranu, S. C. Bruner.

Cicadella Dum.
(Dumeril 1817b: 189)

Logotype *Cicada viridis* Linne 1758a: 438

This genus has had numerous species assigned to it since Van Duzee reestablished it in 1916. There are no Cuban species in this genus as we have restricted it here. A reexamination of *C. viridis* (Fig. 51) shows the following characters: Crown broad, sometimes strongly produced, obtuse anteriorally; ocelli deeply impressed; clypeus strongly inflated; eyes prominent. Pronotum about twice as broad as long, anterior margin broadly curved, lateral margins short, posterior margin nearly straight. Tegminae with three large anteapical cells. Aedeagus with elongate anterior, ventral and posterior processes.

Cicadella sanguinicollis Latr.

Tettigonia sanguinicollis Latreille 1811a: 191

While described from Cuba nothing remotely resembling this highly colored species has since been found there, and it seems practically certain that there has been a mistake with regard to the origin of the type. Judging from Signoret's description and figure in his "Revue" it seems likely that it was really obtained in some continental locality in the Neotropical Region. Its length is given as 16mm., very much larger than any other Cicadellid known from Cuba. It is therefore not considered in the present work as belonging to the fauna of this country. The type was in Signoret's collection.

Kolla Dist.
(Distant 1908g:223)

Orthotype *Kolla insignis* Distant 1908g:223.

This genus was described to include two species from India. It has been extended since to include 37 species from all parts of the World. We are not convinced that all these species are congeneric but until the type can be restudied in comparison with the other species we prefer to assign the species listed below to this genus.

The genus *Kolla* Dist. as represented by our Cuban species may be characterized as follows: Head nearly as broad as pronotum; crown broadly rounded the anterior margin continu-

ing the contour of the eyes; cheeks below antennae distinctly carinate; front tibiae ciliate; radius branching before the apex of clavus; media and cubitus unbranched before the membrane; claval veins not united. Crown and pronotum in the known species transversely fasciate; aedeagus with the ventral processes elongate, as long as the pygofers.

Kolla fasciata Walk. Figs. 14, 28

Tettigonia fasciata Walker 1851b: 780

Fasciata was described from the United States and has been reported from the West Indies, Mexico and Central America. Van Duzee considers *fasciata* as a variety of *bifida* Say. We believe, however, that the Cuban material is specifically distinct from that of North America. This species might be confused with *carabela* as it has the same general color pattern, the essential differences being that in *fasciata* the anterior margin of the pronotum is ferruginous and the veins are broadly bordered with black.

Kolla carabela n. sp. Figs. 36, 52.

This species has been recorded as *Kolla geometrica* Sign. which was described from Colombia and has been reported from the West Indies, Central America, Mexico, and the Southeastern United States. We do not believe, however, that the species from Cuba is the same as the one reported from the Southeastern United States. We have named the Cuban species *carabela* until the species from Colombia can be reexamined.

The specimens from Cuba are generally dark green above marked with black and yellowish green. The anterior border of the pronotum is black, and the veins of the tegminae narrowly bordered with black. This species is widely distributed in Cuba, having been collected in practically all the areas where extensive collections have been made.

Head nearly as wide as the pronotum; crown short, slightly produced on median line, about three-fourths as long as the pronotum. Pronotum nearly twice as broad as long; the anterior margin broadly curved, the posterior margin slightly concave.

Color: Crown black the posterior border greenish yellow, a broad greenish yellow fascia anterior to ocelli projecting on median line to anterior of the crown, and including a small black spot. Pronotum mostly dark green, anterior margin black bordered posteriorly by a greenish-yellow fascia; posterior

border greenish-yellow bordered anteriorally with black. Scutellum greenish yellow with the anterior border and the impressed line black. Tegminae dull green, the apical transparent area infuscated; the veins narrowly fuscous or black. Face largely testaceous, with two large black spots dorsally. Genae and lorae black. Legs dull yellow. Abdomen testaceous.

Length: Female 5. 25 mm. Male 3.5 - 4 mm.

Holotype: Female, Sierra Rangel, August 29, 1927, J. Acuña.

Allotype: Male, Sto. Tomás, May 5 - 9, 1927, S. C. Bruner and J. Acuña.

Paratypes: Eleven females, Santiago de las Vegas, Havana, Sto. Tomas, Sierra Rangel, Bahia Honda, and ten males from Santiago de las Vegas, Carabela, Santiago, Las Animas, Jarahueca.

Ciminius gen. n.

Orthotype *Tettigonia harti* Ball 1901b: 61.

This genus may be distinguished from other Cicadellid genera by the peculiar venation and genitalia. It comes closest to *Kolla* Distant.

Crown triangular broader than long; the anterior margins continuing the margins of the eyes; the dorsal surface sloping to meet the slightly inflated face. Pronotum broad. Scutellum broad. Tegminae short; cell radius one without an apical cell; with a medial anteapical cell. Anterior tibiae ciliate. Posterior tibiae with a few coarse spines not ciliate.

Ciminius harti Ball Figs. 34, 53.

Tettigonia harti Ball 1901b: 61

This species was described from the Southern United States and Cuba. It may be recognized from other Cuban species by its small size, tegminae dark brown or dull black with veins pale.

Head conical; crown obtusely rounded, twice as wide as long, about two-thirds as long as pronotum.

Female last ventral segment nearly truncate, slightly incised either side to form a small median tooth. Male plates about half as long as pygofers, broad at base tapering to elongate points.

Color: Female brownish. Crown with light slightly curved fascia across apex in front of ocelli and a pair of black spots on

posterior border behind ocelli. Pronotum buffy, irregularily marked with brown. Tegminae brown with veins buffy. Face with numerous dark brown arcs; apex and median area pale. Male darker dull black with numerous pale markings.

Collected from several localities in Cuba as follows: Baragua, Bahia Honda, Santiago de las Vegas, Casa Blanca, Nagua, Corralillo, Herradura, Pinar del Rio Province. Osborn records it from Camagüey Province.

Hadria gen. n.

Orthotype *Hadria convertibilis* n. sp.

This genus may be distinguished from the other Cuban genera by the broad obtuse head; by the simple venation; with tegminae heavy and opaque, veins straight with two anteapical cells. Anterior tibiae strongly ciliate. Male aedeagus simple with a pair of posterior processes.

Hadria convertibilis n. sp. Figs. 11, 35, 54.

A woodland species of moderate size, usually black above heavily marked with numerous light bluish slate and greyish white variable stripes, lowland varieties often more or less washed with yellow; below largely yellow; dorsum of abdomen black.

Head rather short and broad, somewhat triangular with obtuse apex nearly evenly rounded in front; crown slightly more than one-half as long as broad and about three-fifths length of pronotum. Face moderately convex, disc slightly flattened above. Anteclypeus somewhat prominent in center. Pronotum slightly narrower than head, disc with very faint transverse striae. Tegminae moderately broad.

Genitalia: Female, last ventral segment long, about two and one-third times as long as preceding, posterior margin moderately produced into an acute angle with sides sinuate; pygofers with few scattered brown bristles. Male, last ventral segment nearly one-half broader than long, about one-third longer than preceding, posterior margins straight, plates nearly as long as pygofers, apices not produced, rather obtuse, external margins almost straight, with row of pale stiff hairs or slender bristles.

Color: Above largely black heavily striped with paler as follows: Vertex usually with two more or less percurrent, narrow, approximate greyish or yellowish white median stripes,

often broken near apex; two or three parallel yellowish arcs on either side of apex, a greyish or yellowish white irregular oblique stripe passing from inner side of ocelli to behind inner angle of eyes and another similar dash from anterior margin of eyes. Pronotum with two approximate median spots on anterior margin, with two or three smaller irregular spots on either side, greyish white; two broad, parallel vittae from behind median spots and a band of irregular spots on either side along outer paler stripe usually brownish grey or slate colored. Scutellum with a more or less ring-like greyish or yellowish white mark at base on either side and beyond the transverse impressed line two, similar, more or less confluent, stripes converging apically; postscutellum greyish white. Tegminae heavily marked over entire surface with slate grey, more or less broken, uneven, variable stripes, about as wide or wider than intervening black areas; costal cell anteriorly more or less washed with greyish white; translucent apical area dark fuscous with a short well marked white transverse fascia from costal margin to base of third apical cell. Below largely yellow, sometimes more or less suffused with brownish fuscous. Face deep yellow in center with a fuscous spot at apex, sometimes obsolete, usually lightly infuscate on either side and marked with some six or seven oblique parallel pale yellowish stripes; remainder of face yellowish usually without distinct darker markings. Sternum yellow with two dark indefinite maculae on mesosternum. Rostrum and legs buffy yellow or light yellowish brown, tarsi darker. Venter clear yellow; produced apical portion of genital segment of female more or less infuscate; pygofers ventrally greyish white. Abdomen above fuscous black. Wings fuscous with darker veins.

Length: 6 - 7 mm.

Holotype: Female, and Allotype: Male, Las Animas, Sierra Rangel, Pinar del Rio Province, altitude 1,500 ft., April 28, 1933, S. C. Bruner and A. R. Otero.

Paratypes: Many specimens from same locality, J. Acuña, C. H. Ballou, A. R. Otero, S. C. Bruner; Santiago de las Vegas; Los Sabalos, Zapata Swamp (on *Chrysobalanus icaco* Lin. — E. E. A. Cuba No. 8542) and Santo Tomás, P. de Zapata; Santa Clara Province, S. C. Bruner and J. Acuña; Barrie Caobillas, Camagüey Prov., J. Acuña; Nagua, C. H. Ballou and S. C. Bruner, (E. E. A. Cuba No. 8888), Santiago de Cuba, F. Silves-

tri and S. C. Bruner, and Baracoa, S. C. Bruner and L. Boucle, Oriente Province. Male, Jaronu, L. C. Scaramuzza, two females Alguizar Havana, L. C. Scaramuzza, four females, Buenos Aires, Trinidad Mts., S. C. Bruner and A. R. Otero.

This species manifests a perplexing number of what are evidently local color varieties for no definite structural differences have been discovered by which they can be separated. We have selected as the type the insect occuring in the Sierra Rangel Mountains of Western Cuba. This is rather uniform in coloration above, but below may vary from almost entirely pale yellow to fuscous brown with perhaps only the venter dusky yellow. Lowland specimens from Santiago de las Vegas are brighter colored, bluish grey and black above with apex of clavus pale and largely bright yellow below. From the Zapata Swamp and Nagua, Oriente, the pale stripes are broader, often paler and those on clavus more or less suffused with orange yellow, deeper along commissural margins. The face, furthermore, is often heavily marked with black; a broad dark band on either side of disc extending downward to disc of clypeus, usually broken above by transverse pale stripes, a black band from insertion of antennae connecting with former above sides of clypeus, and another shorter streak from below eyes. The black median spot on face may also be continued downward as band. In some specimens from Santiago de Cuba the pale areas above are still broader and those on head and pronotum as well as on tegminae largely yellow or olive yellow.

Pedro Valdés Ragués (1910 a) published Uhler's manuscript name, *"Tettigonia convertibilis"* giving the following abreviated description "5 mm. dark red, No. 76". There are several specimens numbered 76 in the Gundlach Museum among which the present form is certainly included, but more than one species may be represented. Those who adhere to a very strict interpretation of the International Rules may prefer to credit this species to Valdés.

Hadria convertibilis var. *roigi* var. n. Fig. 32.

Similar to *H. convertibilis* but may be distinguished by larger size, stronger black markings on face, and a tendency of the paler stripes on tegminae to break up into rows of spots and dashes.

Genitalia: Female, similar to *H. convertibilis*.

Color: Above largely black with markings similar in arrangement and general appearance to those of typical *H. convertibilis*, but paler longitudinal stripes on tegminae on four of the five specimens are entirely broken up into numerous irregular spots and dashes. This color and corresponding markings on pronotum are largely dark bluish grey with no indication of yellow. The pale markings on head, anterior and lateral margins of pronotum, scutellum and commissural margins of tegminae are greyish white. Below resembling strongly marked forms of *convertibilis* from eastern Cuba. Face pale grey washed with yellowish on sides and clypeus heavily marked with black as follows: A large indefinite median fuscous spot above on face, sometimes extended below towards center, a broad vertical black band on either side extending to anteclypeus, often more or less broken above by pale transverse stripes, sides from antennae to anteclypeus broadly black, the latter with base and disc also largely black; genae with elongated black macula from eyes to lorae; and sometimes a smaller spot over apical half of lorae. Legs bright orange brown, often darker apically. Venter deep yellow, the sternal sclerites with disc more or less fuscous, more broadly so towards base.

Length: 7 - 8 mm.

Holotype: Female, Buenos Aires, Trinidad Mts., Santa Clara Prov., elevation 2,350 - 2,800 ft., S. C. Bruner and A. R. Otero.

Allotype: Male, same locality.

Paratypes: Four females, same data.

Hadria balloui n. sp. Figs. 16, 37.

A relatively large, rather elongate species, largely black above marked with blue and greyish white, with dorsum of abdomen fuscous; related to *H. convertibilis* but readily distinguishable by much greater size, distinctly blue markings and characters of external and internal genitalia.

Head short and obtuse, crown nearly evenly rounded in front, disc somewhat flattened, in female about two and one-half times as broad as long, one-half length of pronotum; eyes relatively small slightly protruding; antennae rather short; face normal; anteclypeus in plane with face to near center, then bent upward forming rounded obtuse angle, more prominent than in *convertibilis*. Pronotum subequal in width to head across eyes,

nearly twice as broad as long, posterior four-fifths shallowly transversally striate, posterior margin nearly straight, very slightly concave. Tegminae of usual form, apex evenly rounded, two moderately large, subequal, oblong, nearly rectangular anteapical cells.

Genitalia: Female, last ventral segment about two and three-fourth times as long as preceding, posterior margin produced into a strong acute tooth; pygofers rather thickly and uniformly covered with brownish yellow bristles. Male, last ventral segment about one-half broader than long, one-third longer than preceding segment, posterior margin nearly straight; valve broad and short posterior margin broadly curved. Plates rather large and stout, gradually curved inwards towards apices, which are short, very obtuse, and overlap, extending behind nearly to apex of pygofers, exterior margins with regular row of deep yellow bristles of moderate length.

Color: Crown largely black with a few small greyish or slightly yellowish markings as follows: Two minute median spots followed by two longitudinal, slightly divergent, short stripes to posterior margin, and few irregular spots between ocelli and eyes. Pronotum largely black, the anterior margin with two median rounded greyish white spots, followed by two irregular parallel dull or bright cobalt blue bands over disc to posterior margin; a narrower sinuate longitudinal band from anterior margin behind center of eye, nearly evanescent before hind margin, and lateral margins largely greyish white; the intermediate pale stripe with few pale spots on inner side of anterior margin followed by irregular broken blue border. Scutellum black with a broken ring-like yellowish or greyish white mark at base on either side of center and a similar heart-shaped mark, sometimes divided in center, at apex; postscutellum yellowish white. Tegminae black with deep cobalt blue, irregular, elongated variable areas over clavus and corium; apex of clavus and broken stripe along commissural margins paler; a short, irregular preapical yellowish white transverse band from near costal margin, usually reaching apex of first anteapical cell. Below largely deep yellow. Face pale buffy yellow heavily marked with fuscous as follows: Face with a very large irregular fuscous median spot above, a series of about seven fuscous brown, more or less broken, oblique, parallel arcs on sides, a very large central macula, covering larger part of apex

and continued over basal half of disc of anteclypeus. Mesosternum largely fuscous. Legs and rostrum more or less embrowned posterior femora paler. Apical tooth of female genital segment brown. Abdomen above fuscous. Wings infuscate with darker veins.

Length: 8.75 mm.

Holotype: Female, summit of Turquino Peak, Sierra Maestra Mts., Oriente Prov., altitude 6,600 ft., July 20, 1922, C. H. Ballou and S. C. Bruner, (E. E. A. de Cuba No. 8886).

Allotype: Male, same data.

Paratypes: Four specimens, same data, at altitudes between 3,600 and 6,000 ft.

The peculiar male genitalia distinguish this species from all others studied from Cuba.

Hadria oteroi n. sp. Fig. 18.

Immediately distinguishable from all known Cuban species by the brillant coloration: Above opaque rosy red marked on head, thorax and tegminae with rich yellow and orange, the maculae sharply defined and bordered with very dark red, or fusco-piceous.

Head short, obtusely angular, well rounded in front, crown about as long as one-half width, somewhat more than one-half as long as pronotum. Eyes not prominent, forming continuous even curve with crown; rather strongly sinuate below on posterior margin. Pronotum nearly as broad as head. Tegminae of usual form.

Genitalia: Female, last ventral segment about four times as long as preceding, considerably produced behind into a moderately acute angle, the apex rounded and provided with a very small angular median tooth; pygofers with few short bristles, mostly pale.

Color: Crown light orange yellow with dark brownish red markings as follows: An irregular transverse subapical line and a broader uneven basal line from inner angle of each eye, these transverse lines connected by a narrow median line. Pronotum with disc covered by a large deep yellow macula, broadly three lobed in front and nearly truncate with median incision behind, surrounded by a dark purplish red irregular border, this darker anteriorly from which project a number of irregular vermiculate

lines, the remainder of anterior portion of pronotum pale grey, as is adjoining narrow central portion of hind margin of head; the pronotum behind macula is rosy red, an indefinite orange spot on lateral margins behind eyes. Scutellum largely yellow, an oblique band across each lateral angle and a small central mark at base dark brownish red; postscutellum brownish pink. Tegminae dull rosy red with deep yellow markings, these broadly but irregularly bordered with very dark or smoky red, as follows: a somewhat rounded spot on clavus near anterior angle, next to suture, a large more distinct rounded macula over center of clavus of both tegminae bisected by commissural line, the apex of clavus for about length of central macula, a rather small ovoid macula somewhat before center of corium, and a large transverse patch just behind apex of clavus, divided by two dark longitudinal veins, these latter markings indefinite in paratype. Behind this there is a small dark orange red, broadly oval, transverse subapical macula, the veins through which are red and inconspicuous. The apical margin and subhyaline apical area are infuscated. The longitudinal veins, except at apex, are broadly very dark red. The costal area behind margin is narrowly washed with yellow. Below, face orange red, paler on disc of clypeus above; clypeus marked with fuscous as follows: a median stripe from base to beyond center, two irregular lines on each side converging at an acute angle below apex, these crossed and more or less broken by about nine oblique parallel pale yellow bars. Apex of clypeus at sides and adjoining base of disc of anteclypeus infuscated as is also the central portion of latter to sides, the apex pale. The lorae and genae largely infuscate. Remainder of under parts including legs pale stramineous except pro-and mesosterni and pleurae which are largely infuscate. The ventral segments laterally and apex and posterior lateral angles of genital segment and basal half of pygofers are washed with fuscous, the remainder of latter with red. The abdomen above is bright crimson. Wings infuscate with darker veins. The single paratype is paler below, without fuscous or red on venter, and the dark markings above are nearly black and yellow areas are orange red.

Length: 7.0 mm.

Holotype: Female, Buenos Aires, Trinidad Mts., Santa Clara Province, elevation 2,350 - 2,800 ft., May 4, 1932, A. R. Otero and S. C. Bruner, on *Coffea arabica;* (E. E. A. de Cuba No. 10,000).

Paratype: Female, Las Animas, Sierra Rangel, Pinar del Río Province, elevation 1,500 ft., April 27, 1933, A. R. Otero and S. C. Bruner, on tree fern (*Alsophila*).

Hadria trinitalis n. sp. Figs. 10, 45.

Very similiar to *Arezzia cubana* but distinguishable by larger size, duller, rather greyish green color, more coarsely and thickly inscribed and striped with black, above, and very different female genitalia.

Vertex moderately produced as in *cubana*, slightly more pointed, somewhat longer than one-half basal width, scarcely three-fifths as long as pronotum. Face with disc flattened. Pronotum as broad as head across eyes. Tegminae rather narrow, narrower than in *cubana*, provided with two short anteapical cells.

Genitalia: Female, last ventral segment, about four times as long as preceding, considerably produced caudad into moderately acute point, rounded at extreme apex; pygofer with few brown bristles. Male, last ventral segment somewhat longer than wide basally, about one and two-thirds as long as preceding, posterior margin nearly straight, plates broad basally tapering to acute apices, slightly curved upwards, not reaching apex of pygofer; sides with a row of closely set brown bristles, a few pale coarse hairs behind.

Color: Above dull greyish or somewhat brownish green and light olive yellow strongly marked with irregular black vermiculate design and longitudinal stripes. Crown usually yellow, often more or less brownish, covered with black variable design of broad irregular vermiculate lines. Pronotum with anterior border to and including posterior lateral angles broadly light olive yellow, the remainder green, concolorous with tegminae, the surface marked with heavy irregular black dashes and lines, tending to form longitudinal stripes; two regular parallel stripes on center of disc and another from behind center of each eye often more or less continuous; black markings on anterior yellow border usually vermiculate and anastomosing. Scutellum light olive yellow with regular design in heavy black uneven lines; postscutellum pale yellow, not white and sharply contrasting with scutellum as in *A. cubana*. Tegminae dull green, often somewhat greyish or brownish, the anterior costal area washed with light olive yellow, and whole surface marked with heavy black longitudinal lines, on and between veins, the

latter tending to be wavy and often more or less broken or incomplete cephalad; the veins surrounding the short anteapical cells are black, more or less distinctly lined with pale on anterior side; whole appendix semitransparent, deep smoky; extreme apex of clavus pale. Below creamy buff lightly washed with brownish olive on sides of head and pleurae. Disc of face at level of insertion of antennae with an angular black or fuscous median spot, immediately around which the disc is pale, then washed with brown, each side with eight or more darker brown but indefinite oblique stripes which extend more or less on paler sides; anteclypeus embrowned basally on disc and often along narrow median ridge to apex. Mesosternum with fuscous patch on sides. Legs with tibiae and tarsi more or less washed with brown, especially anterior pair, often also including an indefinite pale brown anteapical band on anterior and intermediate femora. Apex of genital segment of female slightly embrowned. Abdomen above bright crimson. Wings infuscate with black veins.

Length: 6.4 — 7.3 mm.

Holotype: Female and Allotype: Male, Buenos Aires, Trinidad Mts., Santa Clara Province, altitude 2,350 — 2,800 ft., May 4, 1932, S. C. Bruner and A. R. Otero, on *Coffea arabica*.

Paratypes: Ten specimens, same data.

Adults were very numerous on coffee plants and more or less shrubby growth of surrounding native hardwoods. It is a species peculiar to the Trinidad mountain region.

Hadria labyrinthica n. sp. Figs. 15, 40.

Above green and greenish yellow, rather heavily inscribed with black, the head, pronotum in part, and scutellum with an intricate network of irregular black lines; closely resembling *Arezzia cubana* but distinguishable by clear yellow ground color of clypeus with neither dark median spot above nor brownish wash over disc, the presence of a distinct milky white subapical transverse band on tegminae and shape of genital segment.

Head obtusely triangular with apex well rounded, length of crown rather variable, shorter in male, usually somewhat more than one-half as long as basal width, nearly two-thirds as long as pronotum. Pronotum subequal in width to head. Tegminae moderately broad, narrower apically than in *A. cubana*,

provided with two small subquadrate anteapical cells, nearly equal in length.

Genitalia: Female, last ventral segment long, about three times as long as preceding, posterior margin somewhat angularly produced in center, apex rather broad, distinctly bisinuate, with a small obtusely angular median tooth; pygofers with few short, coarse, brown bristles. Male, last ventral segment transverse, somewhat longer than preceding, posterior margin straight; plates broad basally tapering suddenly to narrow upturned points, almost attaining apex of short pygofers.

Color: Above, crown yellow or greenish yellow covered with a more or less symmetrical and variable design of numerous irregular, curved, partly anastamosing distinct black lines. Pronotum with anterior and lateral margins for about one-fourth length yellow, concolorous with head, and inscribed with similar black lines; remainder green, the whole surface marked with irregular black spots and transverse dashes. Scutellum yellow, concolorous with head, covered with more or less irregular design of distinct curved black lines, forming a cross in center; postscutellum ivory white. Tegminae green, the costal region anteriorly washed with yellow, the longitudinal veins to dark apical area marked with continuous black lines between which is an indefinite row of very irregular spots and curved dashes; apex of tegminae infuscated with paler yellowish brown veins and divided anteriorly by a conspicuous opaque white transverse band from costal margin to oblique subhyaline area which is also infuscated; the extreme apex of clavus washed with milky white. Below usually pale lemon yellow more intense on head towards front, legs pale stramineous, the tarsi and apex of tibiae often darker, clypeus marked with scattered irregular black or fuscous spots, more numerous above, sometimes forming indefinite parallel oblique stripes on sides, no median dark spot on disc; usually a dark patch on margin between face and crown before level of insertion of antennae. Pronotum with black spot on side immediately behind eye. Mesosternum usually dark, the apex of genital segment of female embrowned. Abdomen above bright crimson. Wings infuscated with darker veins. Entire insect sometimes more or less infuscated so that yellow is obscured and green very dark.

Length: 6.0—6.5 mm.

Holotype: Female, and Allotype: Male, San Blas, Trinidad Mts., Santa Clara Province, May 5, 1932, S. C. Bruner and A. R. Otero, (E. E. A. de Cuba No. 10039).

Paratypes: Buenos Aires, Trinidad Mts., elevation 2,350—2,800 ft., S. C. Bruner, A. R. Otero; Central Soledad, Cienfuegos, S. C. Bruner, A. R. Otero; and Santiago de Cuba, S. C. Bruner, Baracoa, S. C. Bruner and L. Bouclé, Nagua (E. E. A. de Cuba No. 8887), C. H. Ballou, S. C. Bruner, Jarahueca, S. C. Bruner, Maisi, J. Acuña, Loma del Gato, all in Oriente Province; Sierra Rangel, Pinar del Río Prov., J. Acuña and A. R. Otero.

This is the common green woodland Cicadella of Oriente Province, where it apparently entirely replaces the very similar. *A. cubana,* with which it may, however, be found in central and western Cuba.

Hadria cubana n. sp. Figs. 13, 38.

In general coloration resembling *H. similis* Walk. but larger and more robust, with a much shorter, more rounded, and broader head; more densely inscribed with black on crown, pronotum and scutellum; tegminae also marked with longitudinal black dashes or lines and abdomen red above.

Crown moderately produced, apex broadly rounded; somewhat longer than one-half basal width, nearly three-fifths length of pronotum; shorter in male. Pronotum scarcely as broad as head across eyes. Tegminae rather broad, provided normally with two short anteapical cells.

Genitalia: Female, last ventral segment long, more than four times as long as preceding; moderately produced behind in center and apex with distinct somewhat rectangular or rounded notch, this usually about twice as wide as deep and sometimes with a small tooth at bottom; pygofers with few short pale brownish bristles. Male, last ventral segment transverse, rectangular, longer than preceding, posterior margin slightly convex, plates broad basally, tapered into long, narrow recurved points.

Color: Above largely green marked with greenish yellow and inscribed with black. Crown yellow covered with black design of narrow vermiculate lines, these somewhat variable and sometimes broken into spots and curved dashes, a narrow median straight line reaching forward from base to center or

beyond. Pronotum with anterior margin broadly yellow to posterior lateral angles, remainder green, the whole surface marked with black vermiculate dashes and spots, mostly arranged transversely, those on anterior yellow portion tending to form continuous lines. Scutellum yellow marked with irregular design of black lines as shown in figure; postscutellum ivory white. Tegminae green, the costal region anteriorly washed with yellow, the longitudinal veins marked with narrow dark fuscous lines between which is a more or less indistinct broken irregular fuscous line; the veins surrounding the short anteapical cells usually largely opaque yellow, appendix subhyaline, lightly infuscate, apical margin darker before which are two or three indefinite small opaque whitish patches; the inner margin behind apex of clavus with a small black dash preceded and followed by minute milky white patches. Below light ochraceous buff, the head anteriorly and meso-and metapleura more or less suffused with yellow, the clypeus at level of insertion of antennae with a small variable, angular median spot, around which it is usually lightly washed with brown and marked on sides with some ten more or less distinct light fuscous arcs; the base of anteclypeus also washed with light fuscous; mandibular sclerites black next the anteclypeal border; the mesosternum with a large fuscous patch on either side; the apex of genital segment of female embrowned; abdomen above bright scarlet red. Wings infuscate.

Length: 6.0—6.75 mm.

Holotype: Female, and Allotype: Male, Santiago de las Vegas, Havana, May 16, 1932, A. R. Otero.

Paratypes: Sierra Rangel, near Taco-Taco, Pinar de Río, J. Acuña, C. H. Ballou, S. C. Bruner, A. R. Otero, (E. E. A. de Cuba No. 8738); Santiago de las Vegas, Havana, A. R. Otero; Pan de Matanzas Mt., Matanzas Prov., L. C. Scaramuzza, S. C. Bruner, A. R. Otero, (E. E. A. de Cuba No. 10010); Cayo Ramona,Ciénaga de Zapata, S. C. Bruner, (E. E. A. de Cuba No. 8544); Barrio Caobillas, Camagüey Province, J. Acuña, Bainoa, S. C. Bruner, Nagua, Oriente Province, S. C. Bruner, Sto. Tomás, Zapata Prov., S. C. Bruner, Valle San Guan, Bahía, Honda, S. C. Bruner.

Although one of the commonest woodland species throughout a large part of Cuba no description has apparently been publish-

ed. Adults occur on the shrubby growth of "guara" (*Cupania cubensis*) and various other small hardwoods. Specimens from the more humid and dense hill-side localities are of a darker green color. The form of the notch on the apex of female genital segment varies considerably.

Arezzia gen. n.

Orthotype *Arezzia maestralis* n. sp.

This genus may be recognized by the peculiar venation and internal male genitalia.

Head about as broad as pronotum, not produced; crown much broader than long; face not inflated. Pronotum broader than long, anterior angles not produced, anterior margin broadly rounded. Scutellum large, broader than long. Tegminae coriaceous; membrane broad; main veins unbranched; two small nearly quadrate anteapical cells. Anterior and posterior tibiae ciliate. Male aedeagus with an elongate assymmetrical process.

Arezzia maestralis n. sp. Figs. 12, 41, 55.

A relatively large, robust, green and yellow species finely marked with black, somewhat resembling *Hadria cubana* n. sp. in coloration but immediately distinguishable by much larger size, broader, much shorter and more obtuse head, transverse wrinkles on pronotum and conspicuously angular anteclypeus.

Head short, thick, slightly broader than pronotum; crown nearly evenly rounded in front, slightly longer on median line, about two and one-half times as broad as long, slightly shorter and more obtuse in male, about half the length of pronotum; eyes not prominent, normal, forming nearly even curve with crown; clypeus considerably flattened, disc slightly convex in lateral view, forming nearly a right angle with crown; anteclypeus continued in same plane as clypeus to center, then bent upward at a very obtuse but conspicuous angle of almost 140 degrees. Pronotum nearly as wide as head, almost twice as broad as long, posterior margin distinctly concave, surface, except anterior yellow portion with very shallow transverse wrinkles. Tegminae rather broad, slightly narrower apically, apex evenly rounded, with two small roundish anteapical cells of about the same size.

Genitalia: Female, last ventral segment about three times as long as preceding, posterior margin moderately and evenly produced in center, apex with a small broad usually rounded

notch on either side of a small short tooth, somewhat variable in length; pygofers along exposed ventral margin subequal in length to last ventral segment, with few stout brownish bristles. Male, last ventral segment about seven-tenths as long as broad, nearly one-fourth longer than preceding segment, posterior margin straight; plates of usual form, slender apices extending nearly to apex of pygofers, stout marginal bristles rather long, pale or brownish, intermixed with few much longer pale hairs.

Color: Above, crown dull yellow marked with intricate, more or less anastomosing, somewhat variable, labyrinth-form pattern in rather thick black lines. Pronotum largely dull green, the anterior and lateral margins broadly yellow, the whole surface marked with dark vermiculate black spots and dashes, these appearing darker and more or less anastomosing on anterior pale margin, similar to those on crown; a small irregular macula behind exterior half of eyes. Scutellum dull yellow or greenish yellow, marked with more or less regular but variable design in uneven black lines, a rough cross over center constant; postscutellum concolorous or slightly paler. Tegminae dull green marked along longitudinal veins to apical transverse veins with black line and between these with wavy broken lines and dashes; apical aerea pale translucent fuscous, the green bordering this usually yellowish, but no distinct transverse pale anteapical macula; veins of apex of tegminae yellow-brown. Below largely pale yellow, more intense on face and pleurae, with dark markings as follows: Clypeus with an irregular, variable, usually rather large fuscous black median spot above and nine or ten oblique, parallel, often unbroken, strong, fuscous brown bars on sides which do not extend below to anteclypeus, the disc sometimes brownish; a small, irregular, fuscous spot on genae beneath eyes and sometimes a smaller more or less distinct mark on disc of anteclypeus; first segment of rostrum often infuscate externally; one or two small indefinite fuscous maculae on sides. Legs with tibiae and tarsi usually buffy or brownish, the posterior femora more or less infuscate apically in front. Apex of genital segment of female slightly embrowned. Abdomen above bright crimson. Wings infuscate with dark veins.

Length: 7.7 - 9.0 mm.

Holotype: Female, and Allotype: Male, Turquino Peak, Sierra Maestra Mts., Oriente Province, altitude 5,000 — 5,500

ft., July 20, 1922, S. C. Bruner and C. H. Ballou, (E. E. A. de Cuba No. 8890).

Paratypes: Twenty specimens, same locality, from the summit of Turquino Peak, Palma Mocha Peak, and other points in the Sierra Maestra, altitudes 4,000——6,600 ft., C. H. Ballou and S. C. Bruner.

This species and *Hadria balloui* are of the same length and are the largest members of the Cicadellinae so far known from Cuba. It was the most abundant Cicadellid found in the Sierra Maestra on the Turquino expedition.

The shallow transverse wrinkles or corrugations on the pronotum are very weak. These and form of the clypeus suggest characters of generic significance; however, the insect is clearly closely related to other species of *Arezzia* and cannot be satisfactorily separated generically.

Arezzia omaja n. sp. Figs. 17, 39.

A rather small species with relatively narrow pointed head; deep yellow and green conspicuously striped with black; abdomen red above.

Head moderately produced, slightly flattened, rather distinctly angled, about three-fifths as long as broad, shorter and more obtuse in male, nearly four-fifths as long as pronotum. Face with disc flattened, surface nearly straight in lateral view, forming angle of about 70 degrees with crown. Anteclypeus normal, slightly prominent in center. Pronotum as broad or slightly broader than head, a gentle transverse depression across median line, behind anterior margin. Tegminae somewhat narrow, apex broadly rounded, two subequal, nearly rectangular anteapical cells of moderate size, about twice as long as broad.

Genitalia: Female, last ventral segment large, about two and one-half times as long as preceding, central area considerably produced with small angular notch on each side of small acute median tooth; pygofers with few brownish bristles. Male, last ventral segment somewhat transverse, posterior margin straight about one-third longer than preceding, plates rather short and broad basally, the narrow recurved apices extending nearly to apex of pygofers, sides with rather long pale bristles and hairs.

Color: Crown, pronotum and scutellum largely greenish yellow or light orange yellow heavily striped with black as follows: Crown with a narrow black median line from base to

near apex, a broad black percurrent longitudinal band with undulating margins on either side from which, anterior to center, a narrow fork runs obliquely backward through ocelli to inner angle of eyes; a narrow black dash on sides of crown from anterior margin of eyes; the narrow median line and broad lateral stripes of crown continued on pronotum to posterior margin, a broad, nearly percurrent stripe from behind each eye; the ground color over disc to posterior margin washed with greenish; scutellum with median stripe of pronotum continued over basal half to dark transverse suture and intermediate stripes continued, gradually narrowed, to either side of apex; postscutellum yellowish. Tegminae with ground color largely green washed with orange yellow along commissural margins, the longitudinal veins marked by rather even black stripes, apical area including anteapical cells fuscous with a conspicuous yellowish white transverse macula rounded behind, extending from costal margin near apical cross veins to fourth apical cell; the costal region anteriorly washed with opaque pale yellow, ground color bordering orange yellow of commissural region, sometimes more or less bluish. Below buff with face and sides washed with yellow and marked with fuscous brown as follows: Clypeus with a conspicuous median spot above near apex and usually two to four incomplete, variable oblique dashes on sides which merge into a solid band below forming arms of large variable, roughly Y-shaped mark, the stalk of which is formed by a broad median band on anteclypeus; small markings on cheeks below eyes and indefinite larger maculae on pleurae; ventral sclerites largely fuscous brown in females and only slightly so in males; the last ventral segment of female has disc and posterior margins fuscous brown. Abdomen above bright crimson. Wings infuscate with darker veins.

Length: 5.3 — 5.9 mm.

Holotype: Female, San Blas, Trinidad Mts., Santa Clara Province, May 5, 1932, S. C. Bruner and A. R. Otero.

Allotype: Male, El Cobre, Oriente Province, October 5, 1928, F. Silvestri and S. C. Bruner, (E. E. A. de Cuba No. 10,037).

Paratypes: Two specimens, San Blas, Trinidad Mts., S. C. Bruner and A. R. Otero; Cumanayagua, Santa Clara, F. de Zayas. One male Nagua, Oriente Province, July 7, 1922, S. C.

Bruner and C. H. Ballou. A pair, Omaja, July 24, S. C. Bruner, one male, Camagüey, July 30, J. Acuña.

Arezzia anachoreta n. sp. Figs. 19, 42.

A rather large stout species with short, rounded head, buffy heavily marked with dark brown vermiculate lines and spots; abdomen red above.

Head short, broadly rounded in front, crown distinctly shorter than one-half basal width, about one-half as long as pronotum. Face moderately convex, disc somewhat flattened. Pronotum slightly narrower than head. Tegminae moderately broad with two small short anteapical cells.

Genitalia: Female, last ventral segment about four times as long as the preceding, considerably produced behind, sides converging concavely to acute point, the apex with a distinct U-shaped notch, thus forming two small very sharp points; pygofers with very few scattered short bristles. Male, last ventral segment nearly as long as broad, about one-third longer than the preceding, posterior margin straight; plates broad and short with apices not appreciably elongated, distinctly shorter than pygofers, pale buff with usual row of fuscous bristles.

Color: Crown pale yellow partly stained with salmon pink and heavily inscribed with fuscous design of irregular anastomosing, somewhat vermiculate lines about as broad as remaining pale areas. Pronotum pale yellow, the anterior one-third heavily marked with broad, irregular, vermiculate anastomosing fuscous lines; the remainder largely dark brown the surface marked with numerous irregular yellowish white spots or blotches mostly arranged transversely; the narrow lateral and posterior margins also yellowish white. Scutellum pale yellow more or less stained with salmon pink and covered with a rather regular design of heavy uneven fuscous brown lines; postscutellum entirely yellowish white, contrasting sharply with scutellum. Tegminae light brown irrorate with pale testaceous; extreme apex of clavus greyish white; a very faint incomplete subapical transverse fascia across base of apical cells; the subhyaline apical area nearly concolorous with rest of tegminae. Below largely pale buffy yellow, slightly stained with pinkish in places and marked with fuscous brown as follows: Clypeus with a large irregular median fuscous spot on disc above and about nine distinct fuscous- brown parallel oblique lines on sides; the

disc also lightly washed with brown except around median spot. Sternum largely infuscate. Legs with a faint anteapical band on femora; tibiae and tarsi lightly infuscate, the claws darker. Venter pale yellow, the pygofers somewhat pinkish, the notch at apex of genital segment embrowned. Abdomen above bright crimson. Wings pale fuscous with darker veins.

Length: 6.50 - 7.75 mm.

Holotype: Female, Buenos Aires, Trinidad Mts., Santa Clara Province, elevation 2,350 - 2,800 ft., May 3, 1932, J. Acuña, (E. E. A. de Cuba No. 10036.)

Allotype: Male, Las Animas, Sierra Rangel, Pinar del Río Province, elevation 1,500 ft., April 28, 1933, S. C. Bruner and A. R. Otero.

Paratypes: Eleven male specimens taken with the allotype, one pair from Camagüey, July 15, 1921, J. Acuña, (E. E. A. de Cuba No. 8689), and one female from Las Animas, Sierra Rangel, May 1933, Hermano Roberto. One male, same data as above. One female, Nagua, Oriente Prov., July 7, 1922, S. C. Bruner and C. H. Ballou. One male, San Nicolas, Ote, July 21, 1927, S. C. Bruner. One female Sierra Rangel, August 28, 1927, J. Acuña and S. C. Bruner, altitude 500 - 1000 ft. One pair, Loma del Gato, Oriente, J. Acuña and S. C. Bruner, October 1. One male, Sierra Rangel, J. Acuña and A. R. Otero.

This relatively large inconspicuously colored species is apparently uncommon. Solitary individuals have been taken only occasionally among other species in sweeping woodland vegetation, except for the twelve male specimens from the Sierra Rangel which among some fifteen or more were attracted to a light placed at the edge of a forest. Two other species (*Hadria cubana* and *Hadria convertibilis*) were both common here but strangely none came to the light except one male of the latter.

There is a damaged specimen of this form in the Gundlach Museum, Havana, labeled "367, Tettigonia sp." Gundlach's records show that this was taken at Bayamo (Oriente Province); it thus appears to occur throughout the Island.

Arezzia baracoa n. sp. Figs. 20, 44.

Readily distinguishable from all other species known from Cuba by having veins of tegminae red and by general colora-

tion: Dull wine red with longitudinal buffy white and fuscous markings above on head and thorax; abdomen red above.

Head broadly triangular with crown well rounded in front, this somewhat longer than one-half basal width and less than three-fifths length of pronotum. Clypeus with disc flattened, nearly straight in lateral view, forming angle of about 75 degrees with crown, somewhat rounded above. Anteclypeus continued in plane with clypeus until just before center, then suddenly bent upward at obtuse angle. Pronotum slightly but distinctly narrower than head. Tegminae moderately broad with two relatively large anteapical cells.

Genitalia: Male, last ventral segment broader than long, about one-fourth longer than preceding segment, posterior margin straight; plates moderately broad basally tapering to slender brown points, regularly upcurved, not quite reaching apex of pygofers, sides with usual row of brown bristles and fine pale hairs.

Color: Above dull wine red with paler and fuscous markings. Crown with a broad pale buff median vitta from base to near apex with rather broad indefinite fuscous border; remainder with indefinite mottled design of dark and pale markings the disc washed with dull red. Pronotum deep wine red with broad nearly percurrent median vitta and a large patch behind eyes including lateral angles buffy white, the latter interiorly and the median vitta with indefinite fuscous border; the anterior portion of pronotum also pale buff, heavily marked with fuscous, the extreme front margin entirely pale. Scutellum largely buffy white with two indefinite curved fuscous markings basally on each side of center; postscutellum pale. Tegminae dull wine red with dark red veins, the surface largely covered with large paler maculae, these tending to form transverse bands apically; the semi-transparent apical area yellowish white; costal margin darker. Below, face pale brown; the center of disc of clypeus and sides paler, the latter with about six indefinite curved oblique parallel light fuscous bars, an indefinite fuscous median patch on clypeus above. Sternum lightly infuscate; the pleurae largely paler. Legs entirely reddish fuscous. Abdomen yellowish white, the basal portion of segments red and center more or less infuscate; the plates pale

with apices brownish. Abdomen above dull crimson. Wings infuscate with darker veins.

Length: 6.5 mm.

Holotype: Male, El Yunque Mt., Baracoa, Oriente Province, April 27, 1929, S. C. Bruner and L. Bouclé, (E. E. A. de Cuba No. 10029).

We know of no other species of the *Cicadellinae* occurring in Cuba which has the veins of tegminae largely red.

Arezzia viridipennis n. sp. Figs. 21, 43.

Closely related to *Hadria oteroi* but slightly smaller and readily distinguishable from that and all other species by very different coloration: Head, anterior portion of pronotum and scutellum pale buff lightly inscribed with thin dark brown lines, the disc and remainder of pronotum heavily mottled with dark brown and washed with green; tegminae green without dark stripes.

Head large, rather short, well rounded in front, slightly broader than pronotum; crown almost twice as broad basally as long, nearly two-thirds as long as pronotum. Tegminae rather broad, provided with two very small anteapical cells, the inner cell much the larger.

Genitalia: Female, last ventral segment more than twice as long as preceding considerably produced, converging somewhat concavely to obtuse apex, this slightly sinuate on either side of very small angular median tooth; pygofer with few short scattered bristles.

Color: Crown buff slightly stained with pinkish in places and inscribed with dark brown vermiculate lines, more numerous and anastomosing on disc, a thin dark median line from base. Pronotum with anterior portion for about three-eights of length, pale buff lightly inscribed with dark brown vermiculate lines, remainder of pronotum heavily mottled with dark brown and washed with dull green, contrasting with pale forepart.. Scutellum paler buff marked with regular design in dark brown as shown in figure; postscutellum light brown. Tegminae green with thin yellow veins, the posterior subapical cross-veins broadly paler, forming an indefinite transverse anteapical

pale line; the translucent apical area smoky; extreme apex of clavus pale; costal area anteriorly washed with yellow. Below cream white to buffy more or less marked with brown; the clypeus largely dark brown mottled with cream white or, in paler specimens, largely cream white mottled with dark brown, the sides in either case cream white with an indefinite oblique row of dashes below antennae; anteclypeus, genae and lorae cream white, the disc of former largely and markings on latter dark brown. The mesosternum sometimes with a dark brown spot. Abdomen entirely pale below or with venter more or less embrowned; above bright crimson. Wings infuscate with black veins.

Length: 6—6.33 mm.

Holotype: Female, Maisi, Oriente Province, February 5, 1929, J. Acuña.

Allotype: Male, Oriente Province, September 12.

Paratypes: Female, Baracoa, Oriente Province, April 25, 1929, S. C. Bruner and L. Bouclé; Jarahueca, S. C. Bruner.

This very distinct little species is rare and apparently confined to eastern Cuba. There is a specimen in the Gundlach Museum, Havana, labeled "No. 366, Tettigonia sp." Records show this was taken at Baracao.

Arezzia rangeliana n. sp. Figs. 22, 46.

Resembles *Hadria convertibilis* but readily distinguishable by shorter, more obtuse head, paler, brownish coloration with narrower black stripes and by abdomen being red above, not black.

Form relatively robust. Crown short, broadly rounded in front, scarcely one-half as long as basal width and about six-tenths as long as pronotum, still shorter in male. Clypeus with disc flattened, the anteclypeus continued in same plane to center, then abruptly curved backward to apex, forming a broad rounded angle. Pronotum somewhat narrower than head across eyes, about six-tenths as long as broad. Tegminae of the usual form with two oblong anteapical cells, the inner one somewhat shorter.

Genitalia: Female, last ventral segment about four times as long as the penultimate, produced behind into a rather long

point, the apex similar to *Hadria trinitalis*, but less acute; pygofers with few short blackish bristles. Male, last ventral segment less than two-thirds as long as broad, longer than penultimate, posterior margin straight, plates moderately broad tapering to slender, upturned apices not reaching apex of pygofer; sides with usual row of blackish bristles.

Color: Above buffy yellow and light brown striped with black, the stripes on crown and thorax broken into irregular curved lines. Crown dull buffy or slightly pinkish yellow marked with somewhat variable design of irregular curved heavy black lines. Pronotum with anterior margin broadly buffy yellow, remainder light olive brown, marked with irregular, curved heavy black lines, more or less anastomosing especially in front, and tending to form three irregular vittae on either side. Scutellum concolorous with crown, marked with variable design of heavy black curved lines and spots; postscutellum paler yellow. Tegminae sepia marked along longitudinal veins with percurrent black stripes and irregular dashes between; the anterior half of costal area buffy yellow, and extreme apex of clavus pale yellow; the translucent apical area infuscate; a darker fascia from costal margin across basal half of anteapical cells followed by a similar fascia of pale yellow. Below largely amber yellow. Face straw yellow marked with black and fuscous; clypeus with large irregular black spot in center above, the disc below washed with pale fuscous and sides with eight or nine more or less complete, heavy black bars. Mesosternum largely fuscous or blackish. Legs with tibiae and tarsi buffy yellow more or less washed with brown. Apex of genital segment of female and ovipositor infuscate, the sides of pygofers with a smoky patch. Abdomen above bright crimson. Wings infuscate.

Length: 6.3—7.5 mm.

Holotype: Female, and Allotype: Male, Las Animas, Sierra Rangel, Pinar del Río Province, altitude 1,500 ft., April 28, 1933, S. C. Bruner and A. R. Otero, on woody plants in forest.

Paratypes: Sierra Rangel, Pinar del Río, one male April 6, 1922, J. Acuña, C. H. Ballou, S. C. Bruner, (E. E. A. de Cuba No. 8775), and one female from the same region, May 1933, Hon. Roberto, Colegio "La Salle"; Taco Taco, April 1-6, 1922, S. C. Bruner and C. H. Ballou.

Entogonia Mel.

(Melichar 1926a: 360)

Orthotype *Tettigonia sagata* Signoret 1854a: 27

This genus was established for certain species of Cicadellids from the Southern United States, México, Central and South America; with broad nearly flat crowns which are more or less produced in front of eyes. Venation distinct with a distinct first radial anteapical cell.

Entogonia inexpectata n. sp. Fig. 9.

This is a small slender species of a general pale buffy color, with the head, pronutum and mesonotum striped with chestnut brown and the veins of the tegminae marked with chestnut brown. This species is suggestive of *Cicadella occatoria* Say but is somewhat smaller, duller in color and lacks the median dark vitta on the pronotum and mesonotum and the genitalia are entirely different.

Crown broad somewhat elongate, about two-thirds as long as broad; shorter than the pronotum. Head including eyes somewhat broader than pronotum. Face somewhat tumid. Tegminae narrow elongate; nearly twice as long as the abdomen; radius forked before the level of the apex of clavus; legs slender, fore and middle tibiae ciliate.

Genitalia: Male, last ventral segment nearly as long as broad, posterior margin straight; plates elongate, slender apices upturned, about half as long as the pygofer.

Color: Face, crown, pronotum and mesonotum ochraceous orange, the crown with a pair of narrow stripes which unite near the anterior margin, diverging posteriorly to form a distinct V. Outside of these a pair of broader parallel stripes which continue onto the face forming two elongate black marks. There are two short black stripes in front of eyes which continue onto the face. The markings of the crown are continued across the pronotum and the mesonotum. Tegminae warm buff; veins marked with chesnut brown, the apex suffused with chesnut. Legs and venter warm buff.

Length: 4.7 mm.

Holotype: Male, Barrio Caobilla, Camgüey, Cuba, June 23-25, 1927, J. Acuña.

Lucumius gen. n.

Orthotype *Lucumius triangularis* n. sp.

This genus has a superficial resemblance to *Xerophloea* Germ. with the head broadly triangular and the tegminae gradually attenuated giving the body a wedge shaped appearance.

Head with eyes as broad as pronotum; crown short but distinctly conically produced; clypeus broad above the sides distinctly sinuate below the eyes; anteclypeus narrow elongate, the sides nearly parallel. Pronotum broader than long; the anterior angles distinct. Scutellum large, broader than long. Tegminae coriaceous; membranes overlapping so that the apex appears very acute; venation simple, two small anteapical cells. Anterior and posterior tibiae ciliate. Male genitalia simple, aedeagus very short barely exceeding styles with a pair of short posterior processes.

Lucumius triangularis n. sp. Figs. 4, 47, 56.

This is a medium sized species with the general body color ochraceous buff with the crown, pronotum and scutellum with numerous blackish brown vermiculate lines; and the veins of the tegminae narrowly blackish brown.

Crown about one and one-half times as broad as long, conically produced; eyes not protuberant; ocelli large; face somewhat inflated. Pronotum nearly twice as broad as long; anterior margin broadly curved; posterior margin nearly straight. Principal veins of the tegminae unbranched before anteapical cells, broadly curved following the contour of the costal margin.

Genitalia: Last ventral segment of female three times as long as penultimate; posterior margin sinuate forming a broad short median lobe which terminates in a small median triangular tooth; pygofers elongate not inflated. Male genitalia with the plates elongate, triangular, longer than the pygofers.

Color: General color above and below ochraceous buff, heavily marked above with blackish brown; below, with the legs unmarked; dorsum of abdomen bright scarlet. Crown and pronotum with numerous vermiculate blackish brown lines and dashes. Scutellum with a distinct cross formed by a median vitta and a transverse fascia on the impressed line, the distal

ends of the fascia ending in vermiculate lines. Tegminae ochraceous buff with the veins blackish brown and the cells shaded with chestnut brown. Face ochraceous brown with a pair of black spots at the apex, and a black dash next the eyes; and ten chestnut brown arcs.

Length: 6.0 mm.

Holotype: Female, Camegüey, S. C. Bruner.

Allotype: male Camagüey, S. C. Bruner.

Paratypes: One male and one female, same locality.

BIBLIOGRAPHY

Baker, C. F. The *Jassoidea* related to the *Stenocotidae* with special reference to Malayan species. *Philippine Jour. Sci.* 23:345-405; pls. 1-5 1923a.

Ball, E. D. A review of the *Tettigonidae* of North America north of Mexico. *Proc. Iowa Acad. Sci.* 8:35-75; pls. 1-7. 1901b. The genus *Draeculacephala* and its allies in North America. *Florida Ent.* 11:33-40. 1927c.

Blanchard, E. Cuvier's Le Regne Animal 6:52-69; pls. 95-99 1849a.

Distant, W. L. Rhynchotal notes xliv. *Ann. Mag. Nat. Hist.* (8) 1:515-531. 1908a.

Rhynchota-Homoptera. The Fauna of British India including Ceylon and Burma 4:1501; figs. 1-285 1908g.

Dozier, H. L. New and interesting West Indian Homoptera. *American Mus. Nov.* 510:1-24;figs. 1-18. 1931a.

Dumeril, A. M. C. Zoologie Analytique: 1-344. 1806 a.
Cicadelle. Dictionnaire des Sciences Naturelles 9:189. 1817b.

Fabricius, J. C. Systema Entomologiae: 1-816. 1775 a.
Entomologia Systematica 4:1-472. 1794a

Fowler, W. W. Rhynchota: Homoptera. Biologia Centrali-Americana 2:241-248; pl. 16. 1899d.

Geoffroy, E. L. Histoire abregée des insectes 1:1-523; pls. 1-10. 1762a.

Guerin-Meneville, F. E. Historia Fisica, política y natural de la Isla de Cuba por D. Ramon de la Sagra 7:1-868; pls. 1-20. 1856a

Histoire Physique, politique et naturelle de L' Ile de Cuba par M. Ramon de la Sagra:1-868; pls. 1-20. 1857a

Jacobi, A. Homopteren aus Nordost-Afrika Gesammelt von Oscar Neumann. *Zool. Jahrb. Syst.* 19:761-782; pl. 44 1904a

Latreille, P. A. Histoire Naturelle generale et particuliere des Crustaces et des Insectes 3:1-467. 1802a

Insects de l' amerique equinoxiale recueillis pendant le voyage de MM. de Humboldt et Bonpland:127-252; pls. 15-20. 1811a

Cuvier's Le Regne Animal 3:400-408. 18.7a.

Cuvier's Le Regne Animal. Nouvelle Edition 5:209-224. 1829a

Linne, C. Systema Naturae 1:1 - 824. 1758 a.

Systema Naturae. Editio duodecima, reformata. I pars *II*:1-1327. 1767a.

Melichar, L. Monographie der Cicadellinen I. *Ann. Mus. Nat. Hungarici* 21:195-243. 1924a

Monographie der Cicadellinen II. *Ann. Mus.. Nat. Hungarici* 22:329-410. 1925a

Monographie der Cicadellinen III. *Ann. Mus. Nat. Hungarici* 23:273-394. 1926a

Monographie der Cicadellinen IV. *Ann. Mus. Nat. Hungarici* 27:285-328. 1932a

Metcalf, Z. P. and Bruner, S. C. Notes and descriptions of the *Cercopidae* of Cuba. Psyche 32:95-105. 1925 a

Membracidae of Cuba. *Bull. Brooklyn Ent. Soc.* 20:203-214; pl. 1. 1925b

Cuban Fulgorina. I. The families *Tropiduchidae* and *Acanaloniidae. Psyche* 37:395-424. 1930a

Myers, J. G. The croton leafhopper, *Cicadella histrio* Fabr. *Ann. Mag. Nat. Hist.* (10) 1:376-377. 1928d

Nottingham, J. O. The genus *Carneocephala* (*Cicadellidae*). *Jour. Kansas Ent. Soc.* 5;97-115. 1932a.

Olivier, A. G. Hemipteres, section I. Encyclopedia Methodique Histoire Naturelle 4:1-331. 1789a

Osborn, H. Notes on the Economic Status of certain Cuban Homoptera. *Jour. Econ. Ent.* 19:99-106, 1926a.

V. Neotropical Homoptera of the Carnegie Museum. Report upon the collections in the subfamily *Cicadellinae,* with descriptions of new species. *Ann. Carnegie Mus.* 16: 155-248; pls. 11-16. 1926b

Faunistic and Ecologic notes on Cuban Homoptera. *Ann. Ent. Soc. America* 19:335-365; pls. 30-31. 1926c.

Insects of Porto Rico and the Virgin Islands. Homoptera excepting the *Sternorhynchi. Sci. Surv. Porto Rico and Virgin Islands* 14 (2):111-260; figs. 1-70. 1935a

Riley, C. V. Leaf-hoppers injuring wheat fields. *American Ent.* 3:78. 1880a

Say, T. Descriptions of new North American Hemipterous

insects belonging to the first family of the section Homoptera of Latreille. *Jour. Acad. Nat. Sci. Philadelphia* 6:299-314. 1830b

Sherborn, C. D. Index Animalium 6:1197 - 1452. 1925 a.

Signoret, V. Revue inconographique des *Tettigonides.*
Ann. Soc. Ent. France (3) 1:13-40; pl. 2, 1853a
Same. (3) 1:323-374; pls. 8-12. 1853b
Same. (3) 1:661-688; pls. 21-22. 1853c
Same. (3) 2:5-28; pls. 1-2. 1854a
Same (3) 2:341-306; pls. 11-12. 1854b
Same. (3) 2:483-496; pl. 17. 1854c
Same. (3) 2:717-732; pl. 21. 1854d
Same. (3) 3:49-60; pl. 6. 1855a
Same. (3) 3:225-240; pls. 6-12. 1855b
Same. (3) 3:507-528; pl. 21. 1855c
Same. (3) 3:765-836; pls. 23-24. 1855d

Stal, C. Hemiptera mexicana enumeravit species que novas descripsit. *Stett. Ent. Zeit.* 25:49-36. 1864a
Hemiptera Fabriciana. Fabricianska Hemipterarter, efter de i Kopenhamn och Kiel Forvarade Typexemplaren Granskade och Beskrifne. 2. *K. Svenska Vet. Akad. Handl.* 8 (1): 1-130. 1869a.

Valdés Ragués, P. Classificación Gundlach de Hemipteros Cubanos, conforme a los Ejemplares que existen en el Museo del Instituto de 2ª Enseñanza de la Habana. *An. Acad. Cien. Habana* 46:425-446. 1910a

Van Duzee, E. P. A catalog of the described *Jassoidea* of North America. *Trans. American Ent. Soc.* 21:245-317. 1894a
Check list of the Hemiptera of America north of Mexico:1-111. 1916a
Catalogue of the Hemiptera of America north of Mexico excepting the *Aphididae, Coccidae,* and *Aleurodidae. Tech. Bull. Univ. California Agr. Exp. Sta.* 2:1-902. 1917b

Walker, F. List of specimens of Homopterous insects in the collection of the British Museum 3:637-907. 1851b.

PLATE III

Fig. 1. *Hortensia similis* Walk.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

Fig. 2. *Hortensia filicis* M. and B.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

Fig. 3. *Poeciloscarta histrio* Fabr.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

Fig. 4. *Lucumius triangularis* M. and B.

A. Dorsal view of head and thorax; C. Female genitalia.

Fig. 5. *Hortensia gundlachiana* M. and B.

A. Dorsal view of head and thorax.

Fig. 6. *Hortensia conciliata* M. and B.

A. Dorsal view of head and thorax.

Fig. 7. *Poeciloscarta laticeps* M. and B.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

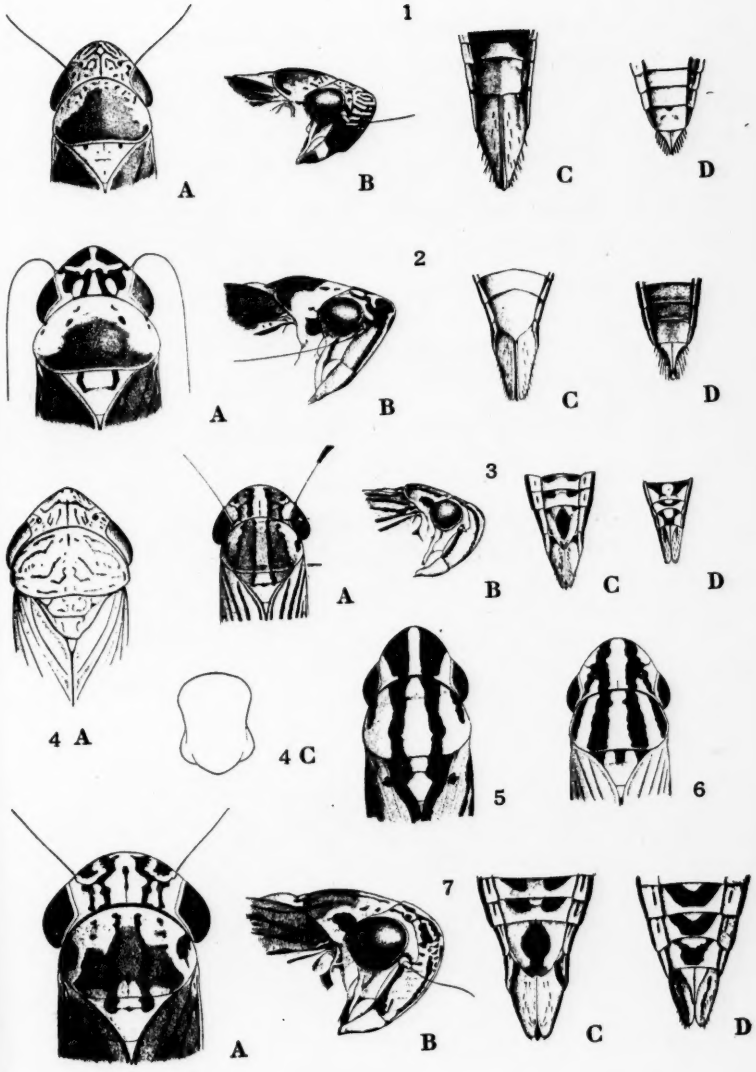

1
A
B
C
D
2
A
B
C
D
3
A
B
C
D
4 A
4 C
5
6
7
A
B
C
D

PLATE IV.

Fig. 8. *Poeciloscarta cardini* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

Fig. 9. *Entogonia inexpectata* M. and B.
A. Dorsal view of head and thorax.

Fig. 10. *Hadria trinitalis* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

Fig. 11. *Hadria convertibilis* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

Fig. 12. *Arezzia maestralis* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

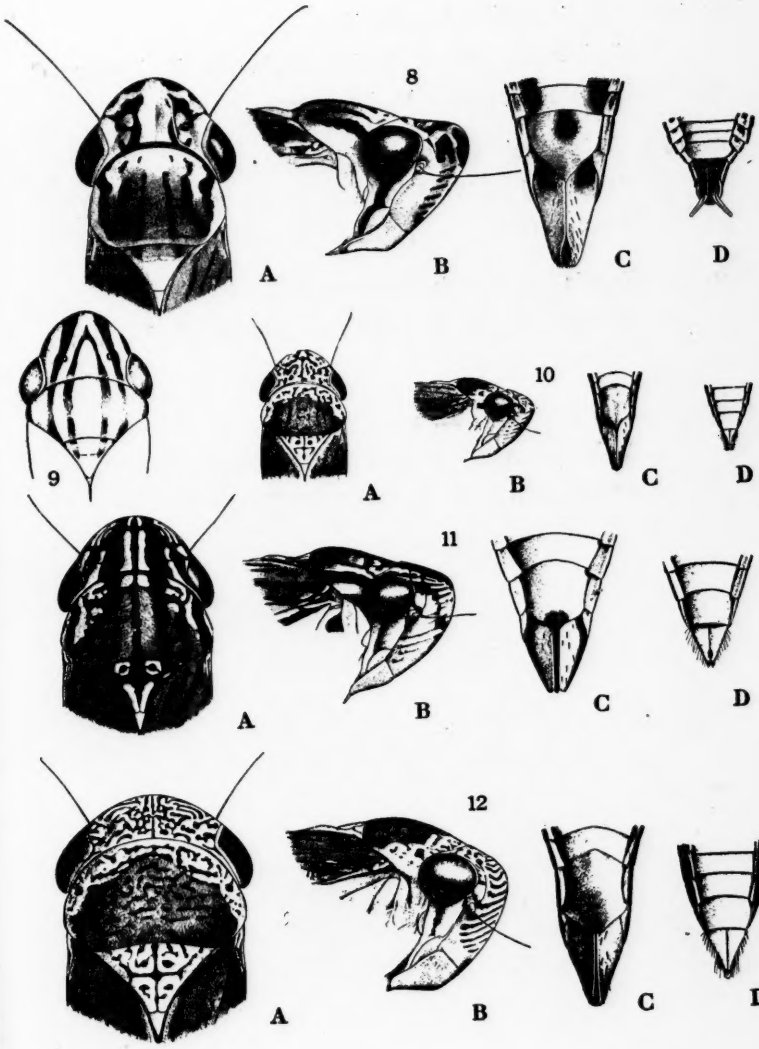

8
A
B
C
D
9
A
10
B
C
D
11
A
B
C
D
12
A
B
C
D

PLATE V.

Fig. 13. *Hadria cubana* M. and B.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; E. Face.

Fig. 14. *Kolla fasciata* Walk.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

Fig 15. *Hadria labyrinthica* M. and B.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; E. Face.

Fig. 16. *Hadria balloui* M. and B.

A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia .

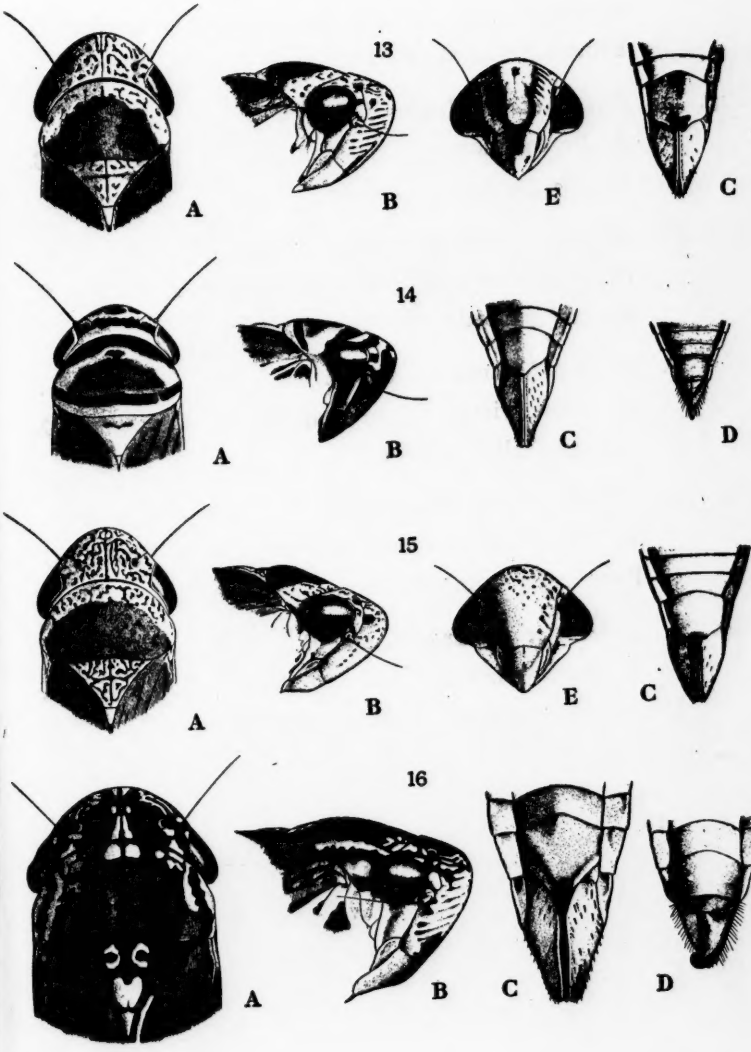

13
A
B
E
C
14
A
B
C
D
15
A
B
E
C
16
A
B
C
D

PLATE VI.

Fig. 17. *Arezzia omaja* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; E. Face.

Fig. 18. *Hadria oteroi* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; E. Face.

Fig. 19. *Arezzia anachoreta M. and B.*
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; E. Face.

Fig. 20. *Arezzia baracoa* M. and B.
A. Dorsal view of head and thorax; B. Profile; D. male genitalia; E. Face.

Fig. 21. *Arezzia viridipennis* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; E. Face.

Fig. 22. *Arezzia rangeliana* M. and B.
A. Dorsal view of head and thorax; B. Profile; C. Female genitalia; D. Male genitalia.

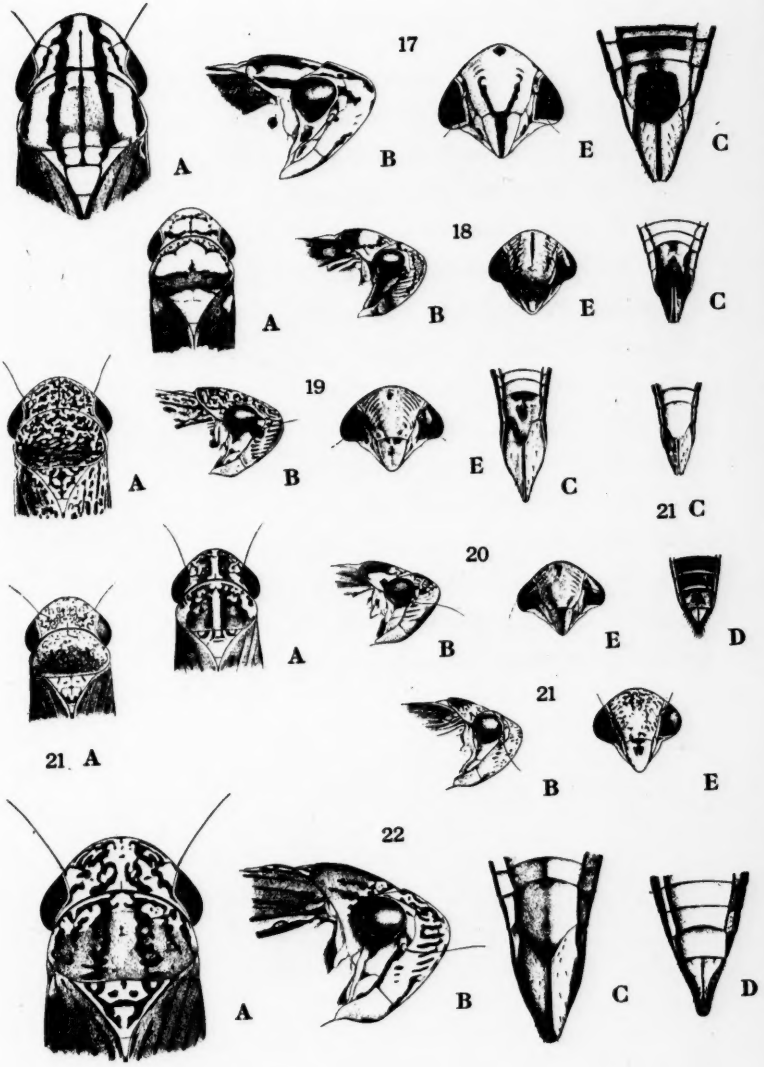
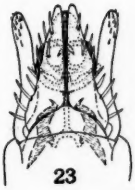

17
A
B
E
C
18
A
B
E
C
19
A
B
E
C
21 C
20
A
B
E
D
21 A
21
B
E
22
A
B
C
D

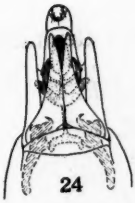
PLATE VII.

Internal Male Genitalia

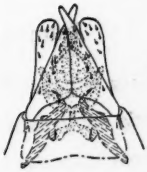
Fig. 23. *Draeculacephala cubana* M. and B.
Fig. 24. *Carneocephala flaviceps* Riley
Fig. 25. *Carneocephala reticulata* Sign.
Fig. 26. *Hortensia filicis* M. and B.
Fig. 27. *Poeciloscarta cardini* M. and B.
Fig. 28. *Kolla fasciata* Walk.
Fig. 29. *Poeciloscarta histrio* var. *baraguensis* M. and B.
Fig. 30. *Poeciloscarta laticeps* M. and B.
Fig. 31. *Hortensia similis* Walk.
Fig. 32. *Hadria convertibilis* var. *roigi* M. and B.
Fig. 33. *Poeciloscarta histrio* Fabr.
Fig. 34. *Ciminius harti* Ball
Fig. 35. *Hadria convertibilis* M. and B.
Fig. 36. *Kolla carabela* M. and B.
Fig. 37. *Hadria balloui* M. and B.
Fig. 38. *Hadria cubana* M. and B.



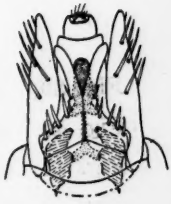
23



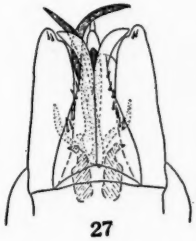
24



25

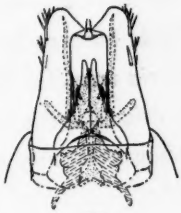


26



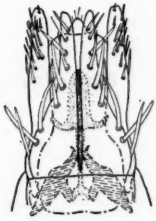
27

28

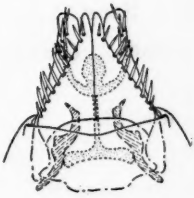


29

30



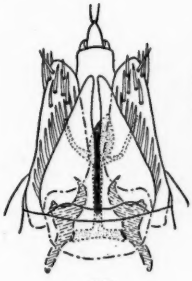
31



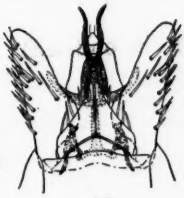
32.

33

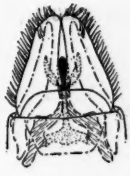
34



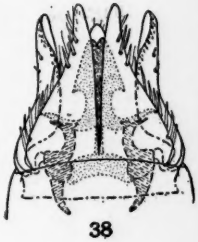
35



36



37



38

PLATE VIII.

Internal Male Genitalia

Fig. 39. *Arezzia omaja* M. and B.

Fig. 40. *Hadria labyrinthica* M. and B.

Fig. 41. *Arezzia maestralis* M. and B.

Fig. 42. *Arezzia anachoreta* M. and B.

Fig. 43. *Arezzia viridipennis* M. and B.

Fig. 44 *Arezzia baracoa* M. and B.

Fig. 45. *Hadria trinitalis* M. and B.

Fig. 46. *Arezzia rangeliana* M. and B.

Fig. 47. *Lucumius triangularis* M. and B.

Tegminae

Fig. 48. *Draeculacephala cubana* M. and B.

Fig. 49. *Hortensia similis* Walk.

Fig. 50. *Poeciloscarta histrio* Fabr.

Fig. 51. *Cicadella viridis* Linne. (Palearctic and Nearctic species.)

Fig. 52. *Kolla carabela* M. and B.

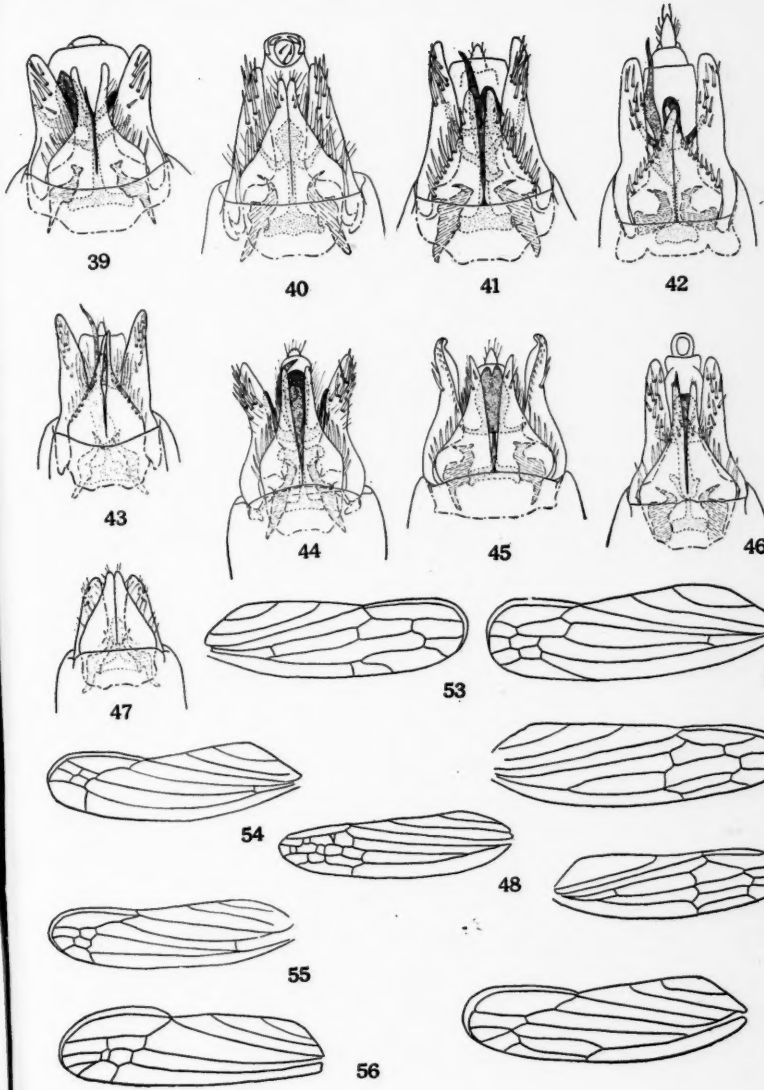
Fig. 53. *Ciminius harti* Ball.

Fig. 54. *Hadria convertibilis* M. and B.

Fig. 55. *Arezzia maestralis* M. and B.

Fig. 56. *Lucumius triangularis* M. and B.

(The cubital vein is omitted)


39
40
41
42
43
44
45
46
47
53
50
54
51
48
49
55
56
52